LEVEL II

PASSAIC RIVER BASIN
TRIBUTARY TO WANAQUE RIVER
PASSAIC COUNTY
NEW JERSEY

ERSKINE UPPER LAKE DAM
NJ 00197

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

DEPARTMENT OF THE ARMY
Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

FEBRUARY 1980

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number):
This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

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DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
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PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO
NAPEN-N

21 JUL 1980

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, New Jersey 08621

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Erskine Upper Lake Dam in Passaic County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Erskine Upper Lake Dam, a high hazard potential structure, is judged to be in good overall condition. The dam's spillway is considered inadequate because a flow equivalent to 81 percent of the Spillway Design Flood--SDF - would cause the dam to be overtopped. (The SDF, in this instance, is one half of the Probable Maximum Flood.) The decision to consider the spillway "inadequate" instead of "seriously inadequate" is based on the determination that dam failure resulting from overtopping would not significantly increase the hazard to loss of life downstream from that which would exist just before overtopping failure. To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The owner should develop an emergency action plan outlining actions to be taken by the operator to minimize downstream effects of an emergency and establish a flood warning system for the downstream communities within three months from the date of approval of this report.

b. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within six months from the date of approval of this report. Within three months of the consultant's findings, remedial measures to ensure spillway adequacy should be initiated.

c. The following remedial actions should be completed within twelve months from the date of approval of this report:

(1) Repair all cracked and spalled concrete on the spillway walls, crest and face.

(2) Remove the 36-inch diameter tree stump abutting the downstream face of the spillway.

(3) Fill areas of erosion along the embankment crest and regrade, eliminating the unever vertical alignment.

(4) All brush and trees should be removed from the downstream and upstream slopes. The embankment face and crest should then be seeded to develop a growth of grass for surface erosion protection.

(5) Investigate the embankment for animal burrows and fill in any burrow holes with impervious material.

(6) Remove debris from the downstream channel and place riprap protection at the erosion area.

d. The following actions should be initiated in conjunction with the consultant's studies:

(1) Consider providing additional low-level outlet facilities to decrease drawdown time.

(2) Conduct a complete topographic survey of the embankment in order to develop a detailed plan and several cross-sections of the dam. Annotate and update the existing drawings to form a coherent as-built set.

e. Start a program of periodically inspecting the dam. Within one year from the date of approval of this report the owner should also develop written operating procedures and a periodic maintenance plan to ensure safety of the dam.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman Roe of the Eighth District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

NAPEN-N
Honorable Brendan T. Byrne

An important aspect of the Dam Safety Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

Copies furnished:
Mr. Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

Mr. John O'Dowd, Acting Chief
Bureau of Flood Plain Management
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

ERSKINE UPPER LAKE DAM (NJ00197)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 19 November and 3 December 1979 by Harris-ECI Associates, under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Erskine Upper Lake Dam, a high hazard potential structure, is judged to be in good overall condition. The dam's spillway is considered inadequate because a flow equivalent to 81 percent of the Spillway Design Flood--SDF - would cause the dam to be overtopped. (The SDF, in this instance, is one half of the Probable Maximum Flood.) The decision to consider the spillway "inadequate" instead of "seriously inadequate" is based on the determination that dam failure resulting from overtopping would not significantly increase the hazard to loss of life downstream from that which would exist just before overtopping failure. To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The owner should develop an emergency action plan outlining actions to be taken by the operator to minimize downstream effects of an emergency and establish a flood warning system for the downstream communities within three months from the date of approval of this report.

b. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within six months from the date of approval of this report. Within three months of the consultant's findings, remedial measures to ensure spillway adequacy should be initiated.

c. The following remedial actions should be completed within twelve months from the date of approval of this report:

(1) Repair all cracked and spalled concrete on the spillway walls, crest and face.

(2) Remove the 36-inch diameter tree stump abutting the downstream face of the spillway.

(3) Fill areas of erosion along the embankment crest and regrade, eliminating the uneven vertical alignment.

(4) All brush and trees should be removed from the downstream and upstream slopes. The embankment face and crest should then be seeded to develop a growth of grass for surface erosion protection.

(5) Investigate the embankment for animal burrows and fill in any burrow holes with impervious material.

(6) Remove debris from the downstream channel and place riprap protection at the erosion area.

d. The following actions should be initiated in conjunction with the consultant's studies:

(1) Consider providing additional low-level outlet facilities to decrease drawdown time.

(2) Conduct a complete topographic survey of the embankment in order to develop a detailed plan and several cross-sections of the dam. Annotate and update the existing drawings to form a coherent as-built set.

e. Start a program of periodically inspecting the dam. Within one year from the date of approval of this report the owner should also develop written operating procedures and a periodic maintenance plan to ensure safety of the dam.

APPROVED: James G. Ton

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

DATE: 1 July 1980

PASSAIC RIVER BASIN

TRIBUTARY WANAQUE RIVER, PASSAIC COUNTY

NEW JERSEY

ERSKINE UPPER LAKE DAM

NJ00197

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

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DEPARTMENT OF THE ARMY

PHILADELPHIA DISTRICT, CORPS OF ENGINEERS

PHILADELPHIA, PENNSYLVANIA 19106

FEBRUARY, 1980

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

Name:	Erskine Upper Lake Dam, I.D. NJ 00197
State Located:	New Jersey
County Located:	Passaic County
Stream:	Tributary Wanaque River
River Basin:	Passaic River
Date of Inspection:	November 19 and December 3, 1973

Assessment of General Conditions

Erskine Upper Lake Dam is an earthfill dam containing a concrete weir spillway at the left end of the dam. The overall condition of the dam is good. There is no major sign of distress or instability in the embankment. The low-level gate valve is in operable condition. The hazard potential is rated as "high".

The adequacy of Erskine Upper Lake Dam is considered questionable in view of its lack of spillway capacity to pass the SDF (1/2 PMF) without overtopping the dam. The spillway is capable of passing a flood equal to 40 percent of the PMF (80 percent of the 1/2 PMF), and is assessed as "inadequate".

At present, the engineering data available is not sufficient to make a definitive statement on the stability of the dam, but based on the findings of the visual inspection, the preliminary assessment of the static stability is that it is satisfactory. The following actions are recommended along with a timetable for their completion. All recommended actions should be conducted under the supervision of an Engineer who is experienced in the design, construction and inspection of dams.

1. Carry out a more percise hydrologic and hydraulic analysis of the dam within twelve months, to determine the need and type of mitigating measures necessary. Based on the results of these studies, remedial measures should be instituted. This should include the installation of a tailwater gage.

2. Repair all cracked and spalled concrete. This work should be started within twelve months.

3. Remove 36-inch tree stump abutting downstream face of spillway within twelve months.

4. Fill areas of erosion along embankment crest and regrade eliminating uneven vertical alignment. This should be started within twelve months.

5. All brush and trees should be removed from the downstream and upstream slopes to avoid problems which may develop from roots. The embankment face and crest should then be seeded to develop a growth of grass for surface erosion protection. This program should be started within twelve months.

6. Investigate embankment for animal burrows and fill in any burrow holes with impervious material.

7. Remove debris from downstream channel and place riprap protection at erosion area. This work should be started within twelve months.

8. The owner should develop an emergency action plan (if one is not already available) outlining actions to be taken by the operator to minimize downstream effects of an emergency and establish a flood warning system for the downstream communities within three months.

Furthermore, while of a less urgent nature, the following additional action is recommended and should be carried out within 24 months.

1. Consider providing additional low-level outlet facilities to decrease drawdown time.

2. Conduct a complete topographic survey of the dam and surrounding area, in order to develop a detailed plan and several cross-sections of the dam. Annotate and update the existing drawings, and form a coherent as-built set.

3. The owner should develop within one (1) year after formal approval of the report, written operating procedures and a periodic maintenance plan to insure the safety of the dam.

John P. Talerico

John P. Talerico, P.E.
HARRIS-ECI ASSOCIATES

Photo taken on February 15, 1980.

E R S K I N E U P P E R L A K E D A M

View toward right end of dam. Portion of spillway is in foreground.

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the office of the Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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NATIONAL DAM SAFETY PROGRAM

ERSKINE UPPER LAKE DAM, I.D. NJ 00197

S E C T I O N 1

1. PROJECT INFORMATION

1.1 General

a. Authority

The National Dam Inspection Act (Public Law 92-367, 1972), provides for the National Inventory and Inspection Program by the U.S. Army Corps of Engineers. This inspection was made in accordance with this authority under Contract C-FPM No. 35 with the State of New Jersey who, in turn is contracted to the Philadelphia District of the Corps of Engineers, and was carried out by the engineering firm of Harris-ECI Associates, Woodbridge New Jersey.

b. Purpose of Inspection

The visual inspection of Erskine Upper Lake Dam was made on November 19, 1979. The purpose of the inspection was to make a general assessment as to the structural integrity and operational adequacy of the dam embankment and its appurtenant structures.

c. Scope of Report

The report summarizes available pertinent data relating to the project; presents a summary of visual observations made during the field inspection; presents an evaluation of hydrologic and hydraulic conditions at the site; presents an evaluation as to the structural adequacy of the various project features; and assesses the general condition of the dam with respect to safety.

1.2 Description of the Project

a. Description of Dam and Appurtenances

Erskine Upper Lake Dam is an earthfill dam approximately 800-foot long and 17-foot high, with a concrete core wall, and partial steel sheet piling cut-off. There is a 40-foot wide concrete weir spillway with concrete abutments 55 feet from the left end of the dam. The crest of the spillway is 2-feet below the top of dike.

The embankment has a top width of 8 feet with a 2H:1V slope on both faces. The upstream slope of the dike has riprap and is constructed of impervious fill material while the donwstream slope is constructed with pervious fill material. The concrete core wall, which is 2-foot thick, is one foot from the top of the dike and its foundation is either in glacial till or sand. Where the sand exists, a steel sheet piling cut-off has been driven into the hard pan. The cut-off is from the low-level outlet to the right end of the dam according to the construction reports. The depth of the cut-off varies from 16 feet at the outlet to 12 feet at the right end.

The low-level outlet consists of a 12-inch cast iron pipe through the embankment located at approximately the middle of the dam. A manually operated gate valve, in a concrete manhole with the operating stem extending through the concrete cover, controls the flow. The manhole is located on the crest of the dam. The inlet end of the pipe is located at the upstream toe of slope and is a screen-covered 4 ft. x 4 ft. concrete chamber. The outlet discharges into the downstream channel.

The downstream channel runs parallel to Lakeview Drive and crosses under it through two 36-inch concrete pipes opposite the low-level outlet. From there, the channel runs into Erskine Lake.

There are no logs of the test pits, shown on Plate 3, that were taken for the design of this dam. A partial soil profile is shown on Plate 4. It shows that a variable thickness sand strata ran along a portion of the dam. The remaining soils are not identified and the depth to rock is not noted. The profile does indicate that the rock is deeper than 10 feet.

A generalized description of soil conditions is contained in Report No. 3, Passaic County, Engineering Soil Survey of New Jersy, by Rutgers University. The report describes the dam area soils as glacial ground moraine deposited during the Wisconsin glaciation. The soils are unstratified, heterogeneous materials including clay, silt and sand sizes, with varying amounts of gravel, cobbles and boulders. The depth to rock is erratic but is usually shallow. Geologic Overlay Sheet No. 23 shows the rock to be Pyroxene or Pytoxene Gneiss.

b. Location

Erskine Upper Lake Dam is located on a tributary to the Wanaque River in the Borough of Ringwood, Passiac County, New Jersey. It is accessible by way of Lakeview Drive.

c. Size Classification

According to the "Recommended Guidelines for Safety Inspection of Dams" by the U.S. Department of the Army, Office of the Chief of Engineers, the dam is classified in the dam size category as being "small", since its storage area of 404 acre-feet is less than 1, 000 acre-feet. The dam is also classified as "small" because its height of 17.0 feet is less than 40 feet. The overall size classification of Erskine Upper Lake Dam is "small".

d. Hazard Classification

A hazard potential classification of "high" has been assigned to the dam on the basis that a hypothetical failure would result in excessive damage to the five houses located on the other side of Lakeview Drive immediately across from the dam, and the possibility exists of the loss of more than a few lives in the event of dam failure.

e. Ownership

Erskine Upper Lake Dam is owned by:

Erskine Lakes Property Owners' Association, Inc.
8 Point Place
Ringwood, NJ 07456

Attention: Mr. Paul Sullivan
(201) 962-4185

f. Purpose

Erskine Upper Lake Dam is presently used for recreation purposes only.

g. Design and Construction History

construction of Erskine Upper Lake Dam was started in June 1930 and c. pleted in March 1931. Construction plans and specifications are on file at the New Jersey Department of Environmental Protection (NJ-DEP).

During an inspection in July 1931, with the lake level full, seepage was reported along the downstream toe of embankment from the right edge of the spillway for a distance of approximately 50 feet. This seepage was measured in October 1931, and in May 1932, and the amount of flow remained constant at approximately 21 gpm, and the flow was perfectly clear. On July 15, 1932, it was recommended to accept the dam.

According to correspondence on file at the NJ-DEP, plans were made to place grout along the upstream face of the core wall to stop the seepage in the fall of 1932. No record is on file of this actually being done.

h. Normal Operating Procedures

The discharge from the lake is unregulated and allowed to naturally balance the inflow into the lake. The low-level outlet is used to lower the lake level approximately 18-inches every fall to prevent ice damage and is opened during times of heavy rains. Also, approximately every 5 years, the lake level is lowered to allow the property owners to make repairs to their docks and waterfront property.

1.3 Pertinent Data

a. Drainage Area	0.35 sq.mi.
b. Discharge at Dam Site	
Ungated spillway capacity at elevation of top of dam:	351 cfs (509.0 NGVD)
Total spillway capacity at maximum pool elevation (SDF):	700 cfs (509.26 NGVD)
c. Elevation (Feet above NGVD)	
Top of dam:	509.0
Maximum pool design surcharge (SDF):	509.23
Recreation pool:	507.3
Spillway crest:	507.0
Streambed at centerline of dam:	492.0 (estimated)
Maximum tailwater:	493.0 (estimated)
d. Reservoir	
Length of maximum pool:	1,850 ft. (estimated)
Length of recreation pool:	1,650 ft. (estimated)
e. Storage (acre-feet)	
Spillway Crest:	320
Top of dam:	394
Maximum pool (SDF):	404
f. Reservoir Surface (acres)	
Top of dam:	39.0 (estimated)
Maximum pool (SDF):	39.5 (estimated)
Recreation pool:	N/A
Spillway crest:	35 (507 NGVD)

g. Dam

Type:	Earthfill with concrete weir spillway
Length:	800 ft. (effective)
Height:	17 ft.
Top width:	8 ft.
Side slopes - Upstream:	2H:1V
- Downstream:	2H:1V
Zoning:	Unknown
Impervious core:	840 ft. concrete core wall
Cutoff:	Sheet piling
Grout curtain:	None

h. Diversion and Regulating Tunnel

N/A

i. Spillway

Type:	Concrete weir
Length of weir:	40 ft.
Crest elevation:	507 NGVD
Gates:	None
U/S Channel:	Erskine Upper Lake
D/S Channel:	75-ft. long stilling basin full spillway width

j. Regulating Outlets

Low level outlet:	12-inch C.I.P.
Controls:	Manually operated gate valve
Emergency gate:	None
Outlet:	492 NGVD

SECTION 2

2. ENGINEERING DATA

2.1 Design

Drawings and specifications for the construction of Erskine Upper Lake Dam in 1931 are available in the files at the Trenton office of the New Jersey Department of Environmental Protection (NJ-DEP). One drawing shows the location of test pits taken in the proposed lake bottom. No data from soil borings, soil tests, design computations, or other geotechnical data is available to assess the stability properly. Data concerning the hydraulic capacity of the spillway is also unavailable.

2.2 Construction

Data is not available concerning the as-built construction of the dam. Progress reports during the construction are on file at the NJ-DEP. No data exists of construction methods, borrow sources or other data pertinent to the construction of the dam.

2.3 Operation

Formal operation records are not kept for the dam and reservoir. The lake is allowed to operate naturally without regulation.

2.4 Evaluation

a. Availability

The availability of engineering data is poor. The construction plans and specifications for the dam are avialable from the NJ-DEP. Details of the planned grouting behind the core wall to eliminate the seepage are not available.

b. Adequacy

The engineering data available from the NJ-DEP and from the field was adequate to perform hydrologic and hydraulic computations. The data was insufficient to perform stability analysis, but a preliminary evaluation could be made based on visual observations.

c. Validity

The information contained in the drawings and checked by limited field measurements appears to be valid.

SECTION 3

3. VISUAL INSPECTION

3.1 Findings

a. General

The visual inspection of Erskine Upper Lake Dam revealed the dam including the spillway to be in good condition but in need of some repairs. At the time of inspection, the lake level was approximately 18-inches below the spillway crest.

b. Dam

The earth embankment appears to be sound. No surface cracking on the embankment or at the toe was noted. Erosion of the embankment crest exposing the top of core wall has taken place at three separate locations to the right of the spillway. These locations are approximately 107 ft., 453 ft. and 605 ft. from the spillway. The erosion is relatively narrow and shallow at the crest and spreads out at the downstream toe. Minor vertical crest misalignment exists along the embankment. This could be the cause of the erosion due to rainfall runoff channelization since local residents claim the dam has never been overtopped. No riprap failures were noted. Numerous trees and shrubs are growing along both the upstream and downstream sides of the embankment. No seepage or sloughing was found in any portion of the downstream face of the embankment. No evidence of burrowing by animals was observed; however, at the time of the inspection the embankment was covered with leaves, therefore the possibility does exist that there may be burrow holes in the embankment.

c. Appurtenant Structures

1. Spillway

The concrete spillway appears in fair condition. Horizontal and vertical alignment of the spillway crest appears good. At the center of the spillway, a 36-inch diameter tree stump abuts the downstream face. It appears that the tree once exerted lateral pressure against the spillway as there is a vertical crack in the vicinity of the stump. There is heavy spalling along the upstream face and the top of spillway. The riprap along the upstream apron is in fair condition.

2. Outlet Works

The intake for the 12-inch cast iron pipe was under water and could not be observed. The pipe discharges at the downstream toe of slope directly into the downstream channel. There is no headwall and the pipe is in good condition. At the time of inspection, tools to remove the cover

of the gate valve pit were not available, therefore the condition of the valve could not be checked. However, the valve was able to be operated satisfactorily.

d. Reservoir Area

The reservoir side slopes are moderate to steep. There is no indication of slope instability. Boat landings, houses and trees are around the perimeter of the lake.

e. Downstream Channel

The downstream channel is in fair condition. It is relatively shallow and narrow with debris and cobblestones on the bottom. The channel crosses under Lakeview Drive approximately 360 feet from the spillway and from there, it discharges into Lake Erskine. The channel slopes are very flat to steep along the embankment. There is minor erosion along the left bank, 20 feet from the spillway. Many houses are on the west side of Lakeview Drive directly opposite the dam.

SECTION 4

4. OPERATIONAL PROCEDURES

4.1 Procedures

Erskine Upper Lake Dam is used to impound water for recreational activities. The level of the lake is maintained through the unregulated flow over the spillway. The lake is lowered approximately 18 inches every fall to prevent ice damage. Also, the lake level is periodically lowered to allow property owners to make repairs to their properties.

4.2 Maintenance of the Dam

There is no regular inspection and maintenance program for the dam and appurtenant structures. The Erskine Lakes Property Owners' Association is responsible for the maintenance of the dam.

4.3 Maintenance of Operating Facilities

The low-level outlet operating facilities consist of one manual operated 12-inch gate valve. At the time of inspection, operation of the valve was satisfactorily demonstrated.

4.4 Evaluation

The present operational and maintenance procedures are fair with the dam and spillway being maintained in a serviceable condition.

SECTION 5

5. HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design

The drainage area above Erskine Upper Lake Dam is approximately 0.35 square miles. A drainage map of the watershed of the dam site is presented on Plate 1, Appendix D.

The topography within the basin is flat. Elevations range from approximately 800 feet above NGVD at the east end of the watershed to about 510 feet at the dam site. Land use patterns within the watershed are mostly woodland with concentrated residential development around the lake area.

The evaluation of the hydraulic and hydrologic features of the dam and lake was based on criteria set forth in the Corps Guidelines and additional guidance provided by the Philadelphia District, Corps of Engineers. The Spillway Design Flood (SDF) for the dam is equal to the 1/2 PMF.

The probable maximum flood (PMF) was calculated from the probable maximum precipitation using Hydrometeorological Report No. 33 with standard reduction factors. Due to the small drainage area, the SCS triangular hydrograph transformed to a curvilinear hydrograph was adopted for developing the unit hydrograph, with the aid of the HEC-1-DB Flood Hydrograph Computer Program.

Initial and infiltration loss rates, were applied to the Probable Maximum Precipitation to obtain rainfall excesses. The rainfall excesses were applied to the unit hydrograph to obtain the PMF and various ratios of PMF utilizing program HEC-1DB.

The SDF peak outflow calculated for the dam is 700 cfs. This value is derived from 1/2 PMF, and results in overtopping of the dam, assuming that the lake was originally at the spillway crest elevation.

The stage-outflow relation for the spillway was determined from the geometry of the spillway and dam, utilizing HEC-1-DB program.

The reservoir stage-storage capacity relationship was computed directly by the conic method, utilizing the HEC-1DB program. The reservoir surface areas at various elevations were measured by planimeter from U.S.G.S. Quadrangle topographic map. Reservoir storage capacity included surcharge levels exceeding the top of the dam, and the spillway rating curve was based on the assumption that the dam remains intact during routing.

A breach analysis indicates that the stage of the stream where it crosses Lakeview Drive is 2.4 feet higher, due to dam failure from overtopping, than it would be without failure. This is likely to jeopardize the well traveled road and the houses downstream of the road, but not significantly more than without failure.

Drawdown calculations indicate that to empty the lake to an elevation of 493 MSL through the one low-level sluice would take 15 days, excluding inflow. This is considered to be an excessive drawdown period, and provision of additional outlets should be considered.

b. Experience Data

No records of reservoir stage or spillway discharge are maintained for this site, however residents state the dam has never been overtopped.

c. Visual Observation

The downstream channel is relatively shallow and narrow with some fallen trees and cobblestones on the bottom. The channel crosses under Lakeview Drive, approximately 360 feet from the spillway, then it runs into Erskine Lake. There are many houses directly opposite the dam on the west side of Lakeview Drive.

The slopes of the reservoir are moderate to steep and do not exhibit signs of instability. The drainage area is wooded, moderately flat sloped and developed for residential use around the lake.

d. Overtopping Potential

A storm of magnitude equivalent to the SDF would cause overtopping of the dam to a height of 0.20 feet. Computations indicate that the dam can pass approximately 40 percent of the PMF without overtopping the dam crest. Since 1/2 PMF is the Spillway Design Flood (SDF) for this dam, according to the Recommended Guidelines for Safety Inspection of Dams by the Corps of Engineers, the spillway capacity of the dam is assessed as "inadequate".

SECTION 6

6. STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

There are no major signs of distress in the embankment of the Erskine Upper Lake Dam. Minor vertical crest misalignment is visible. The concrete core wall has been exposed by erosion of the crest in three locations along the embankment. This could be the result of overtopping of the dike but according to the local residents, the dam has never been overtopped. It is quite possible that the vertical misalignment has caused rainwater channelization resulting in the erosion. Trees growing on both slopes of the embankment could pose a threat to the dam's stability. The spillway is in fair condition with a vertical crack near the mid-point and heavy spalling along the upstream face.

b. Design and Construction Data

No design computations relating to stability were uncovered during the report preparation phase. No embankment or foundation soil parameters are available for carrying out a conventional stability analysis on the embankment. No construction data or specifications relating to the degree of embankment compaction are available for use in the stability analysis.

c. Operating Records

No operating records are available relating to the stability of the dam. The dam and spillway have served satisfactorily since the construction in the early 1930's.

d. Post-Construction Changes

There have been no post-construction changes.

e. Static Stability

A static stability analysis was not performed for Erskine Upper Lake Dam because the lack of data on which to base assumptions of material properties within embankment zones might produce misleading results, but based on the findings of the visual inspection, the preliminary assessment of static stability is that it is satisfactory.

f. Seismic Stability

The dam is located in Seismic Zone 1, as defined in Recommended Guidelines for Safety Inspection of Dams, prepared by the Corps of Engineers. In general, projects located in Seismic Zones 0, 1 and 2 may be assumed to present no hazard from earthquake, provided the static stability conditions are satisfactory and conventional safety margins exist. Since static stability safety factors have not been confirmed, it cannot be stated that seismic stability is satisfactory.

SECTION 7

7. ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

a. Safety

The dam has been inspected visually and a review has been made of the available engineering data. This assessment is subject to the limitations inherent in the visual inspection procedures stipulated by the Corps of Engineers for a Phase I report.

The safety of Erskine Upper Lake Dam is in question because the dam does not have adequate spillway capacity to pass the SDF, one half of the PMF, without overtopping. Overtopping of the dam carries with it the danger of possible progressive failure of the dam. The dam's present spillway capacity is approximately 40 percent of the PMF.

No definitive statement pertaining to the safety of the embankment can be made without acquisition of embankment material engineering properties, but based on the findings of the visual inspection, the preliminary assessment of static stability is that it is satisfactory.

b. Adequacy of Information

The information uncovered was adequate to perform hydrologic and hydraulic computations. The data was insufficient to perform even an approximate computation of the stability of the dam. A preliminary assessment of the dam could be made by visual observation only.

c. Urgency

Carry out a more precise hydrologic and hydraulic analysis of the dam within twelve months, to determine the need and type of mitigating measures necessary. If required, conduct a study of the means of increasing spillway discharge capacity and develop alternative schemes for construction. This should include the installation of headwater and tailwater gages. The ability of the dam to withstand overtopping should also be studied.

The existing dam plans and drawings should be annotated and updated to form a coherent as-built set within 24 months.

7.2 Remedial Measures

a. Alternatives for Increasing Spillway Capacity

Alternatives for increasing spillway capacity are as follows:

1. Increase the embankment height, thus permitting a higher discharge to pass over the spillway and reducing the possibility of overtopping.

2. Lower the spillway crest elevation.

3. Increase the effective spillway crest length.

4. A combination of any of the above alternatives.

b. Recommendations

1. Repair all cracked and spalled concrete. This work should be started within twelve months.

2. Remove 36-inch tree stump abutting downstream face of spillway within twelve months.

3. Fill areas of erosion along embankment crest and regrade eliminating uneven vertical alignment. This should be started within twelve months.

4. All brush and trees should be removed from the downstream and upstream slopes to avoid problems which may develop from roots . The embankment face and crest should then be seeded to develop a growth of grass for surface erosion protection This program should be started within twelve months.

5. Investigate embankment for animal burrows and fill in any burrow holes with impervious material.

6. Remove debris from downstream channel and place riprap protection at erosion area. This work should be started within twelve months.

The following additional actions are recommended:

1. The owner should develop an emergency action plan (if one is not already available) outlining actions to be taken by the operator to minimize downstream effects of an emergency and establish a flood warning system for the downstream communities within three months.

2. Consider providing additional low-level outlet facilities to decrease drawdown time.

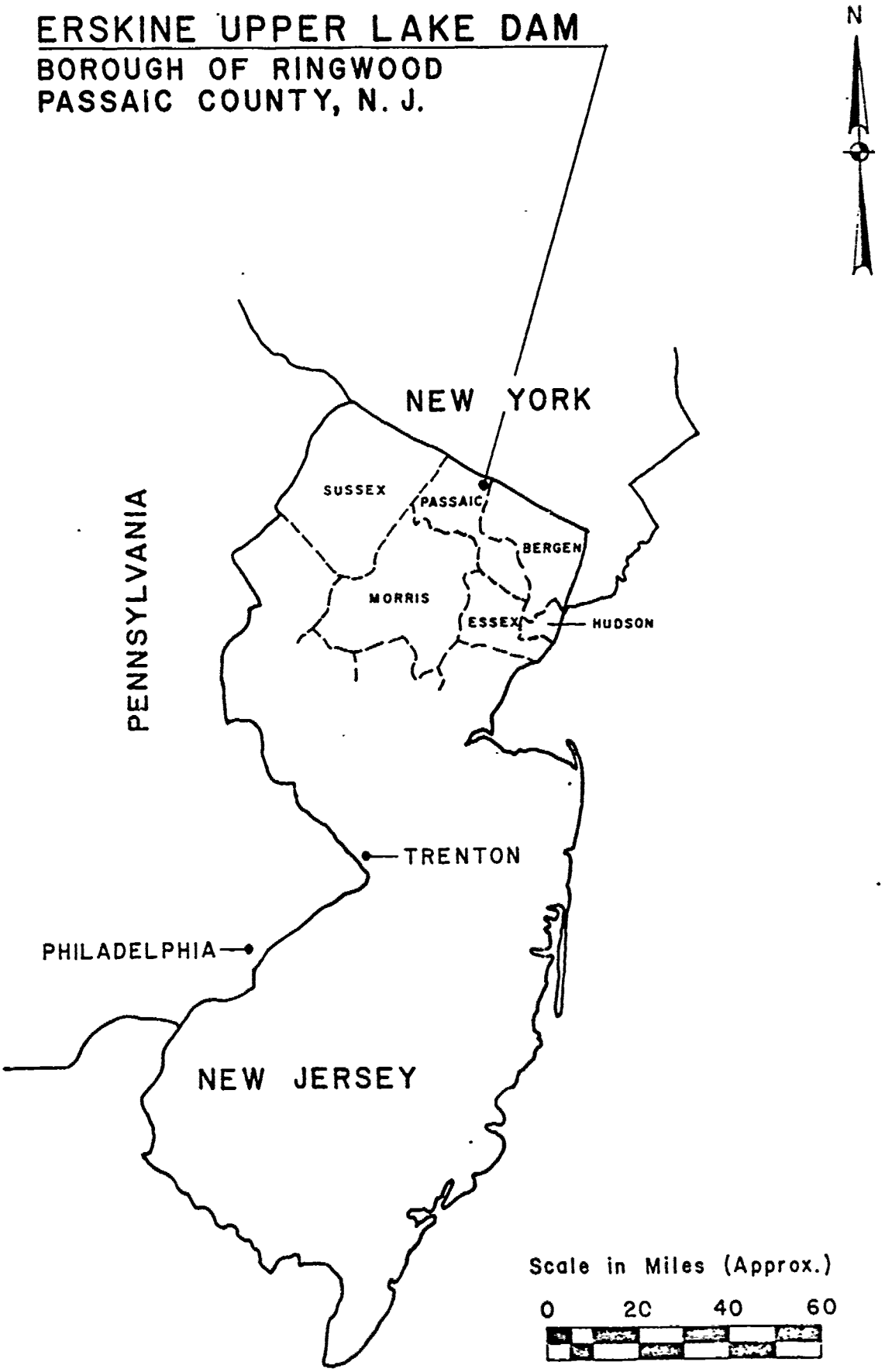
c. O & M Procedures

The owner should develop, within one (1) year after formal approval of the report, written operating procedures and a periodic maintenance plan to insure the safety of the dam.

PLATES

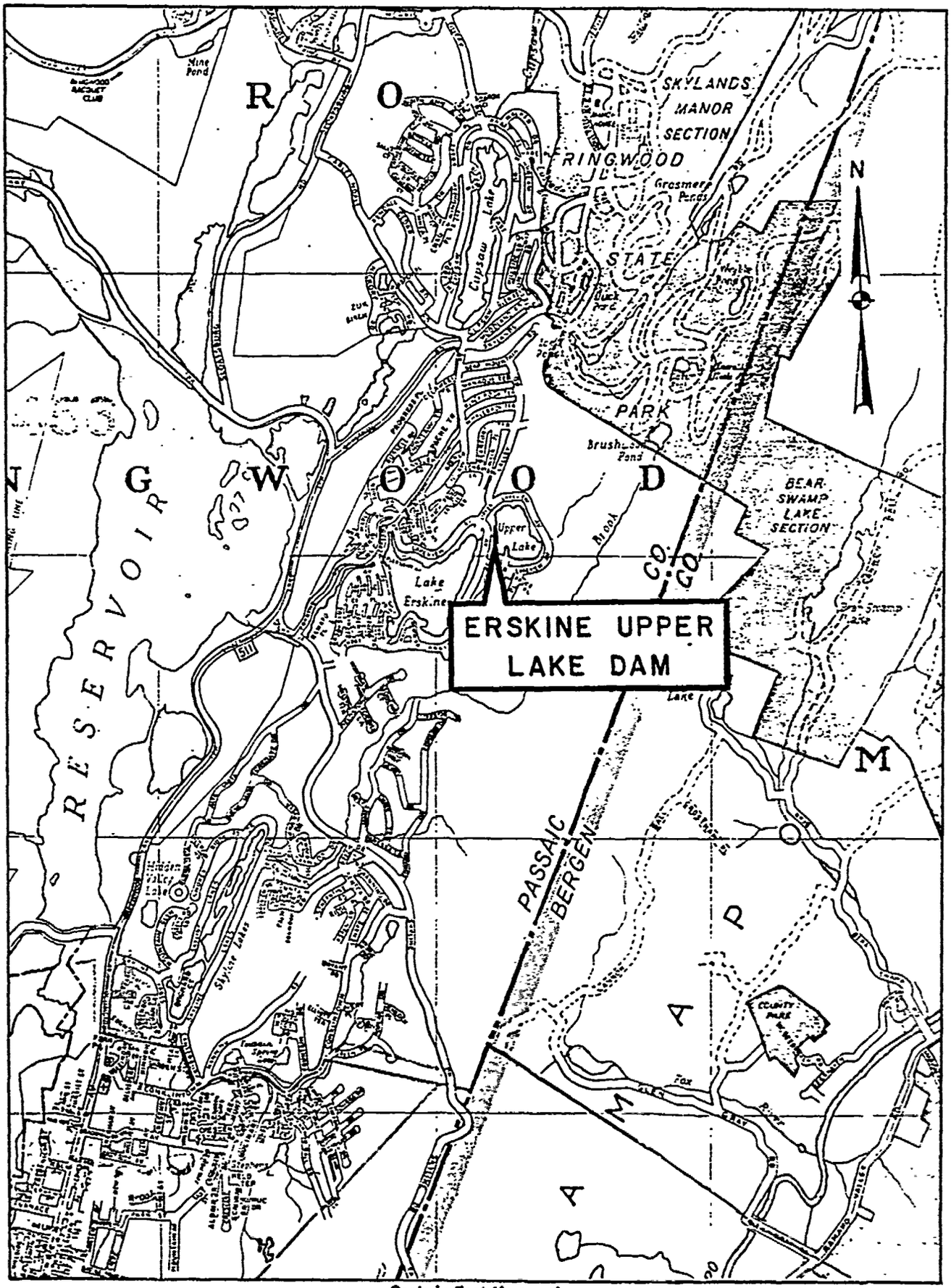
ERSKINE UPPER LAKE DAM

BOROUGH OF RINGWOOD
PASSAIC COUNTY, N. J.



KEY MAP

PLATE 1

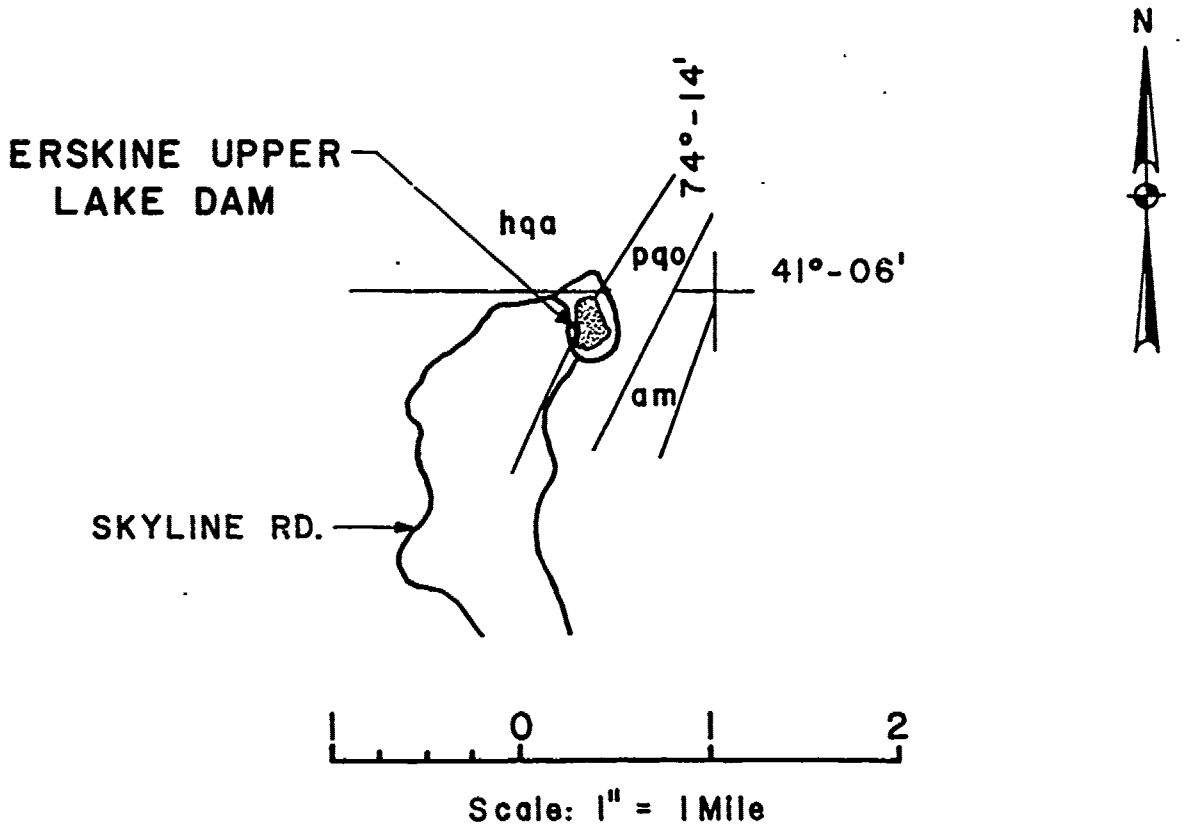


Scale in Feet (Approx.)

2,000 0 2,000 4,000 6,000 8,000 10,000

VICINITY MAP

PLATE IA



LEGEND:

PRECAMBRIAN

am Amphibolite

hqa Pytoxene Gneiss; mainly Quartz-Andesine Gneiss with both Ortho-and Clinopyroxene

pqo Pyroxene Gneiss; mainly Quartz-Oligoclase-Clinopyroxene

GEOLOGIC MAP
ERSKINE UPPER LAKE DAM

PLATE 2

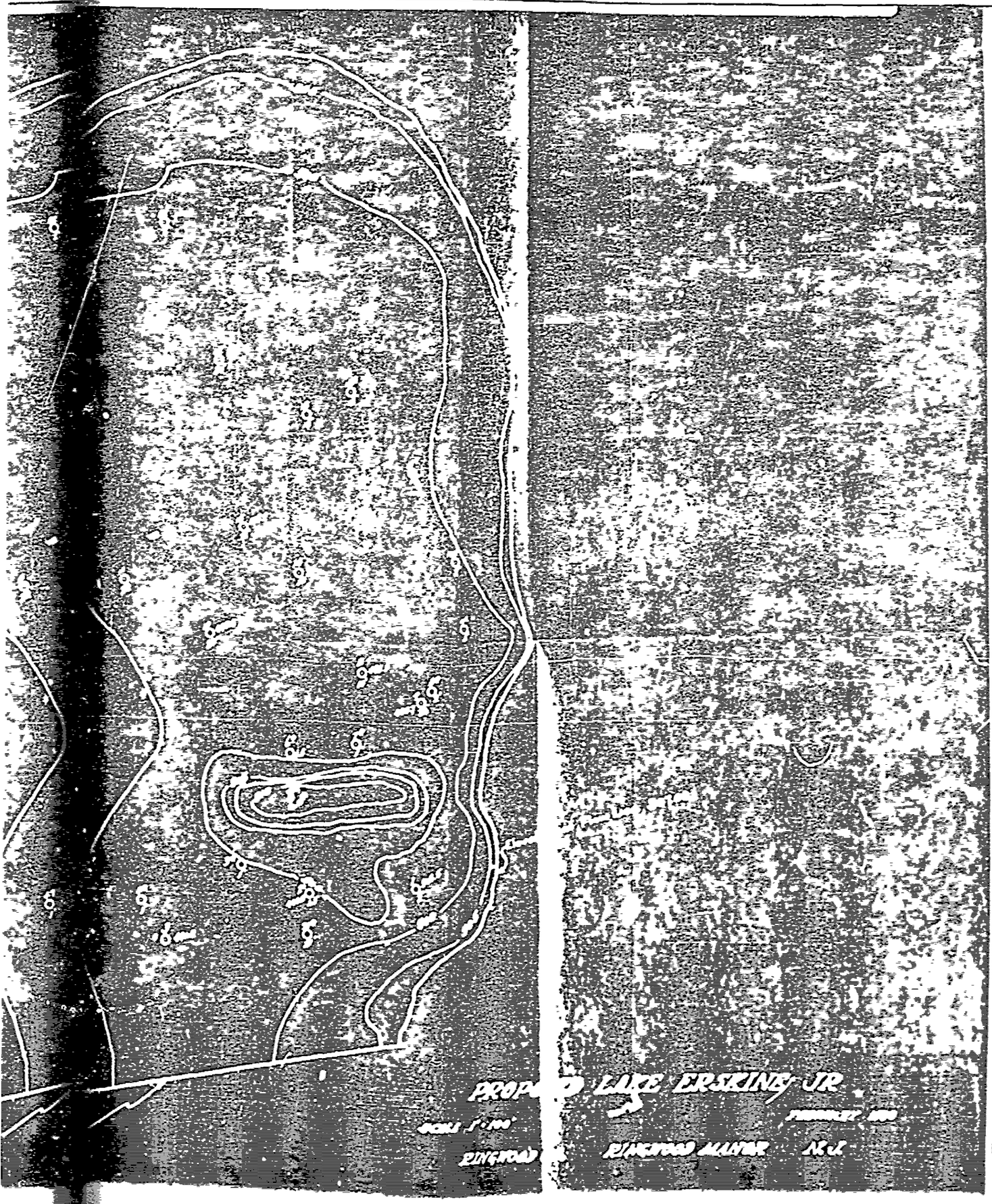
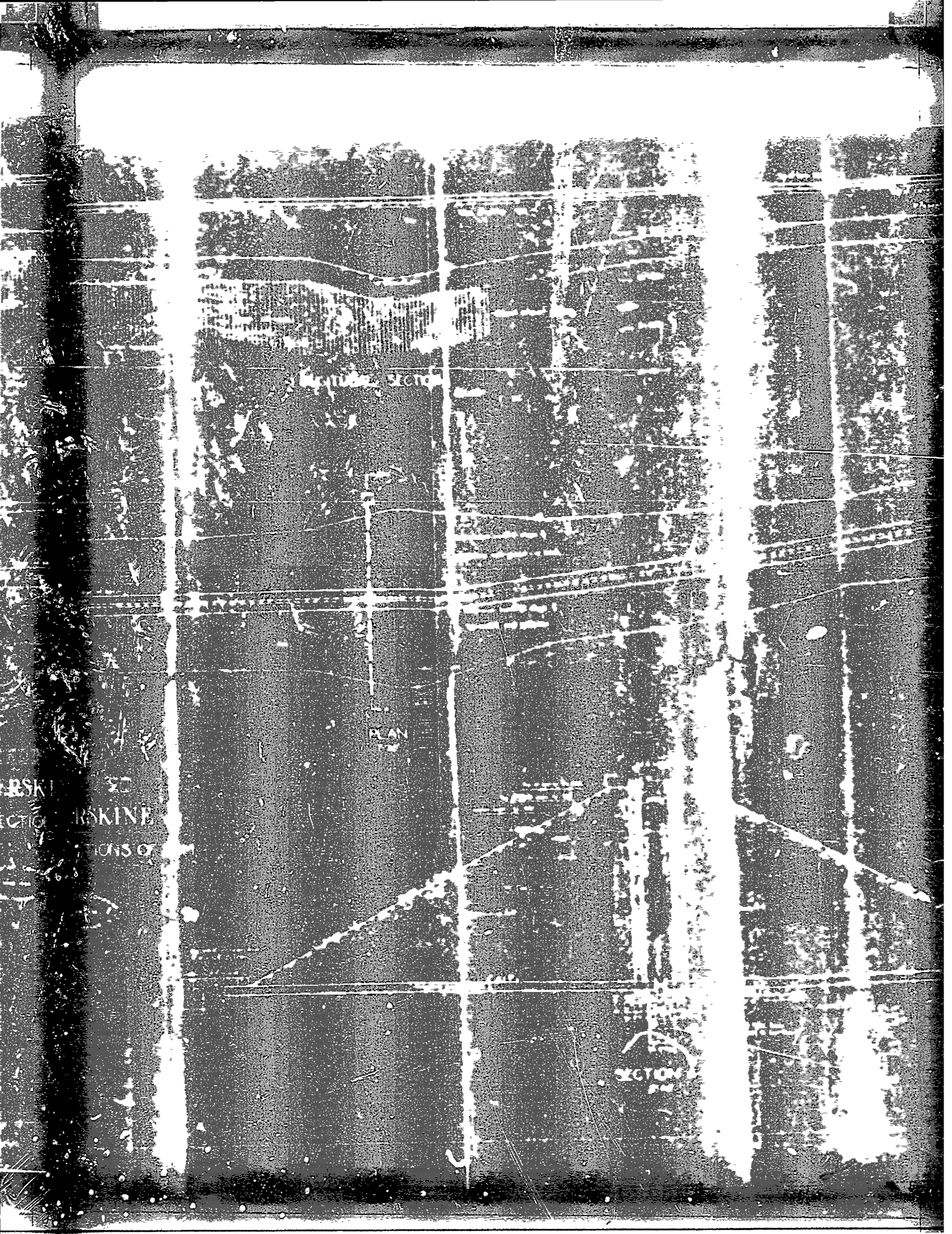


PLATE 3


PLAN
SECTION

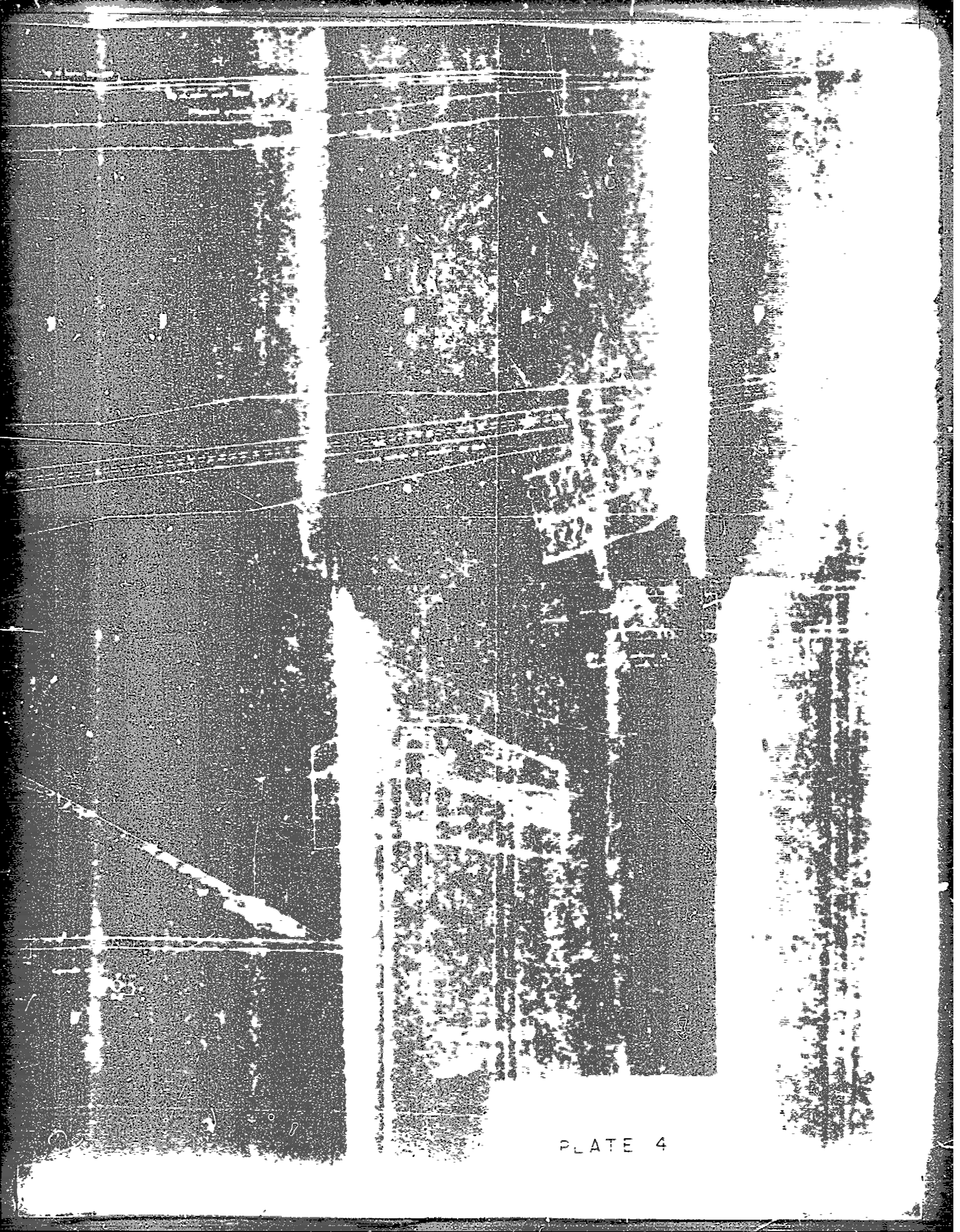


PLATE 4

APPENDIX A

CHECK LIST - VISUAL OBSERVATIONS

CHECK LIST - ENGINEERING, CONSTRUCTION MAINTENANCE DATA

CHECK LIST
VISUAL INSPECTION
PHASE 1

Name Dam ERSKINE UPPER LAKE County Passaic State New Jersey Coordinators NJ-DEP

Date(s) Inspection November 19, 1979
December 3, 1979 Weather Clear Temperature 62° F

Pool Elevation at Time of Inspection 505.5 NGVD Tailwater at Time of Inspection N/A* NGVD

Inspection Personnel:

November 19, 1979:

Chuck Chin
Henry King
Thomas Lakovich

December 3, 1979:

Eugene Koo
James McCormick

OWNER/REPRESENTATIVE:

Paul Sullivan
Erskine Lakes
Property Owners' Association, Inc.
Ringwood, New Jersey 07456

* No tailwater at time of inspection-lake level was below spillway crest.

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SEEPAGE OR LEAKAGE	N/A	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	N/A	
DRAINS	N/A	
WATER PASSAGES	N/A	
FOUNDATIONS	N/A	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES N/A		
STRUCTURAL CRACKING N/A		
VERTICAL & HORIZONTAL ALIGNMENT N/A		
MONOLITH JOINTS N/A		
CONSTRUCTION JOINTS N/A		

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SURFACE CRACKS	None noticed.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	No visible movement or cracking at or beyond the toe was noticed.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Minor erosion exposing the top of concrete corewall at three isolated locations approximately 107 ft., 435 ft. and 605 ft. from the spillway.	Refill areas that have eroded.
VERTICAL & HORIZONTAL ALIGNMENT OF THE CREST	Horizontal alignment good, minor vertical misalignment probably causing channelization of rainfall resulting in erosion of crest.	Regrade crest of embankment to eliminate uneven vertical alignment.
RIPRAP FAILURES	None.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
Numerous trees and shrubs growing on both upstream and downstream slopes of embankment.		Remove trees and shrubs.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM Good condition.		
ANY NOTICEABLE SEEPAGE None noticed.		
STAFF GAGE AND RECORDER None.		
DRAINS None.		

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CRACKING & SPALLING OF CONCRETE SURFACES IN STILLING BASIN	N/A	
INTAKE STRUCTURE	Low level drain under water in lake. Not visible.	
OUTLET STRUCTURE	12-inch cast iron pipe low level outlet discharges directly into downstream channel without a headwall. Pipe in good condition. Gate valve not visible, but was operated satisfactorily.	
OUTLET FACILITIES	None.	
EMERGENCY GATE	None.	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONCRETE WEIR	Concrete spillway has vertical crack apparently caused by 36-inch diameter tree stump abutting downstream face of spillway. Tree has been cut down, but stump remains. Heavy spalling downstream face of spillway and along crest.	Remove stump and repair concrete.
APPROACH CHANNEL	Reservoir.	
DISCHARGE CHANNEL	36-inch diameter tree stump at spillway. See "Concrete Weir" above.	
BRIDGE AND PIERS	None.	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONCRETE SILL N/A		
APPROACH CHANNEL N/A		
DISCHARGE CHANNEL N/A		
BRIDGE AND PIERS N/A		
GATES & OPERATION EQUIPMENT N/A		

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
MONUMENTATION/SURVEYS None		
OBSERVATION WELLS None		
WEIRS None		
PIEZOMETERS None		
OTHER None		

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SLOPES	Moderate to steep side slopes. No indication of slope instability.	
SEDIMENTATION	None noticed	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Debris, mostly fallen trees and cobblestones, along bottom of channel. Minor erosion along left bank of channel, approximately 20 feet from spillway. Channel crosses under Lakeview Drive approximately 360 feet from spillway.	Clean out debris from channel and place riprap protection at erosion area.
SLOPES	Varies from 6:1 to 2:1	
APPROXIMATE NUMBER OF HOMES AND POPULATION	Many houses along west side of Lakeview Drive directly opposite dam. Tennis courts are downstream and to the left of the spillway.	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Available on microfilm at N.J. Department of Environmental Protection (NJ-DEP), 1474 Prospect Street, P.O. BOX CN-029, Trenton, N.J. 08625
REGIONAL VICINITY MAP	Available-Passaic County Map & U.S.G.S. Quadrangle Sheet for Ramsey, NJ-NY.
CONSTRUCTION HISTORY	No formal history exists, but it can be deduced from available plans and drawings.
TYPICAL SECTIONS OF DAM	Available on microfilm at NJ-DEP.
HYDROLOGIC/HYDRAULIC DATA	No Hydrologic data. Hydraulic data available on microfilm at NJ-DEP.
OUTLETS - PLAN	Available on microfilm (NJ-DEP).
- DETAILS	Available on microfilm (NJ-DEP).
- CONSTRAINTS	None.
- DISCHARGE RATINGS	Not available.
RAINFALL / RESERVOIR RECORDS	Not available.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
(continued)

ITEM	REMARKS
DESIGN REPORTS	None available.
GEOLOGY REPORTS	Available U.S.G.S. Geologic overlay sheet for Passaic County and Engineering Soil Survey of New Jersey, Report No. 3--Passaic County, by Rutgers University(New Brunswick, N.J.)
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None available.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None available.
POST-CONSTRUCTION SURVEYS OF DAM	None.
BORROW SOURCES	Unknown.
SPILLWAY PLAN - SECTIONS - DETAILS	Available on microfilm at NJ-DEP.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
(continued)

ITEM	REMARKS
OPERATING EQUIPMENT PLANS AND DETAILS	None available.
MONITORING SYSTEMS	None available.
MODIFICATIONS	None.
HIGH POOL RECORDS	Not kept.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Existing condition report, October 28, 1968, available on microfilm at NJ-DEP.
PRIOR ACCIDENTS OF FAILURE OF DAM - DESCRIPTION - REPORTS	None known to exist.
MAINTENANCE OPERATION RECORDS	None known to exist.

APPENDIX B

PHOTOGRAPHS

(Photos taken on November 19, 1979)

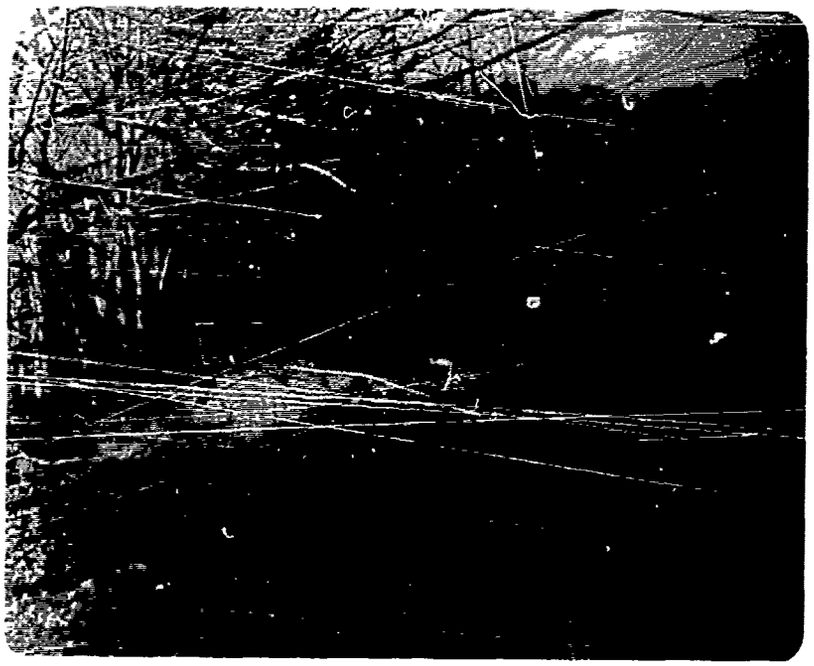


Photo 1 - View of spillway, right abutment and embankment. Lake is on viewer's right. Note crack in spillway (bottom) and 36-inch diameter tree stump adjacent to crack on left.

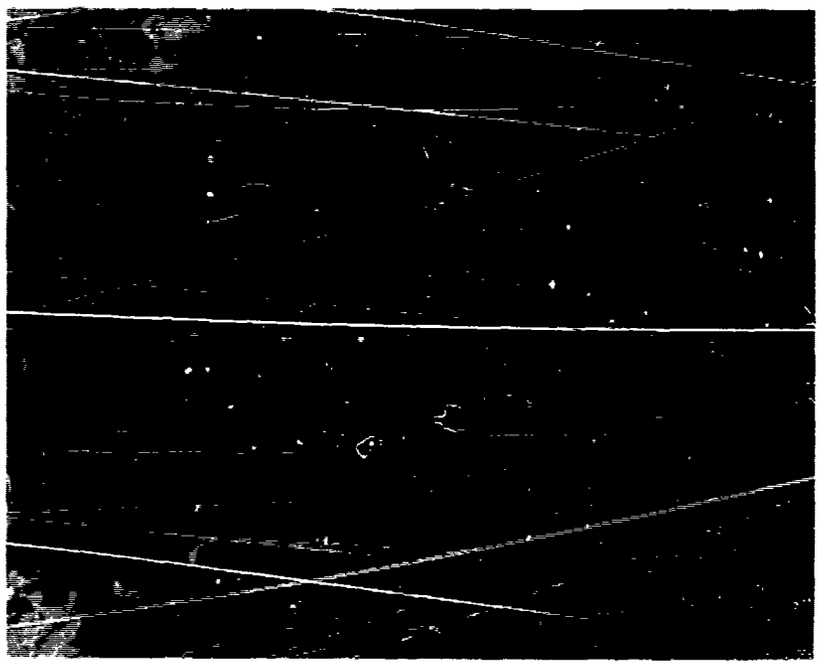


Photo 2 - Detail of crack in spillway and portion of tree stump mentioned above in Photo 1.

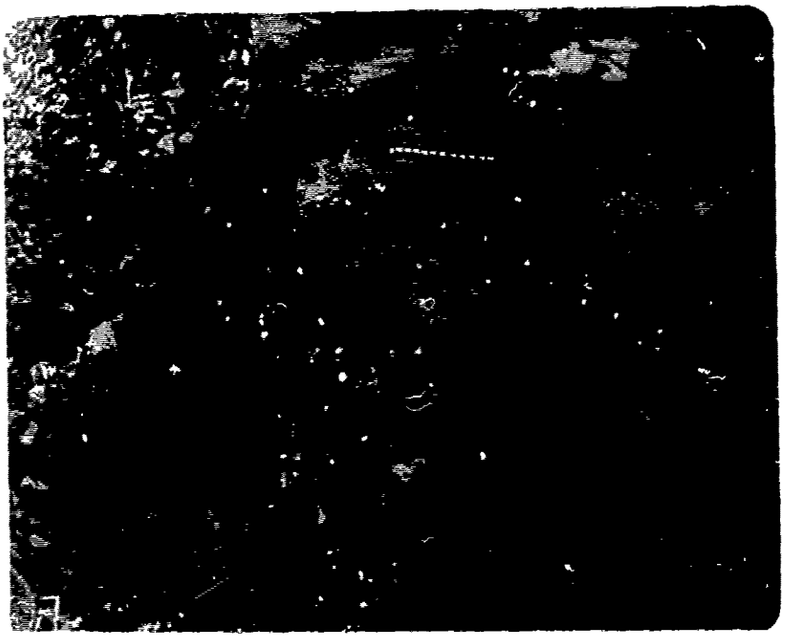


Photo 3 - Detail showing spalling of spillway. Lake is on viewer's right. Crack in spillway is noted in Photos 1 and 2.

Photo 4 - Showing exposed concrete core wall in the embankment.

Photo 5 - View of downstream channel from spillway.

Photo 6 - View of downstream channel looking towards spillway.

Photo 7 - View of channel (2-3 ft. RCP's) crossing under Lakeview Drive, approximately 360 feet from spillway.

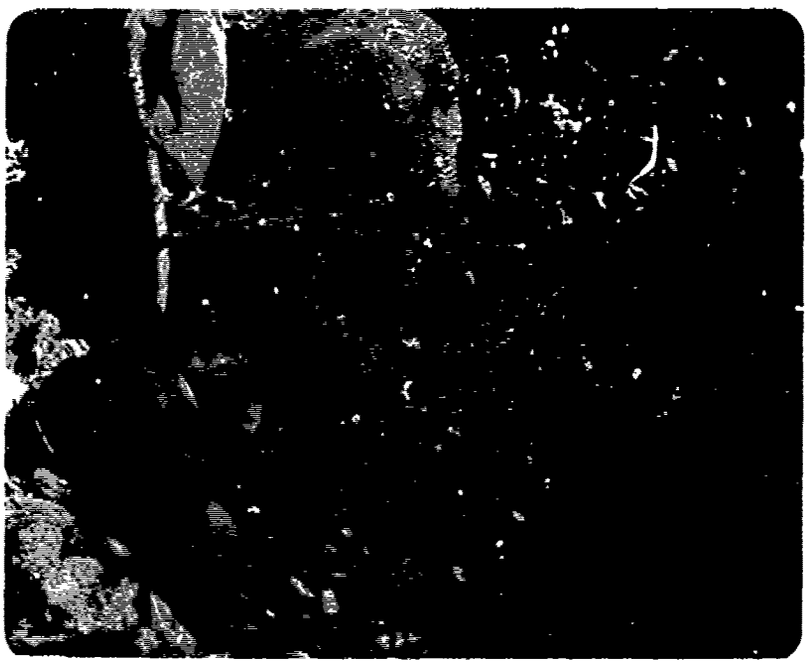


Photo 8 - View of low level outlet (12-inch cast iron pipe) at downstream side of embankment.

Photo 9 - Showing upstream side of embankment. Portion of right abutment of spillway is at left.

Photo 10 - Showing minor erosion of embankment. View is from downstream side of embankment.

APPENDIX C

SUMMARY OF ENGINEERING DATA

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

Name of Dam: ERSKINE UPPER LAKE DAM

Drainage Area Characteristics: 0.35 sq.mi., generally flat, forest & residential

Elevation Top Normal Pool (Storage Capacity): 507.0 NGVD (320 acre-feet)

Elevation Top Flood Control Pool (Storage Capacity): N/A

Elevation Maximum Design Pool: 509.26 NGVD (404 acre-feet; SDF pool)

Elevation Top Dam: 509.0 NGVD (394 acre-feet)

SPILLWAY CREST:

a. Elevation 507.0 NGVD

b. Type Ungated concrete weir

c. Width 2 ft.

d. Length 40 ft.

e. Location Spillover Full length

f. No. and Type of Gates None

OUTLET WORKS:

a. Type One 12-inch diameter low level outlet

b. Location 360 ft. right of spillway

c. Entrance Inverts 492.5 ± NGVD

d. Exit Inverts 492.0 ± NGVD

e. Emergency Draindown Facilities 12-inch with manual operated low level outlet gate

HYDROMETEOROLOGICAL GAGES:

a. Type None

b. Location None

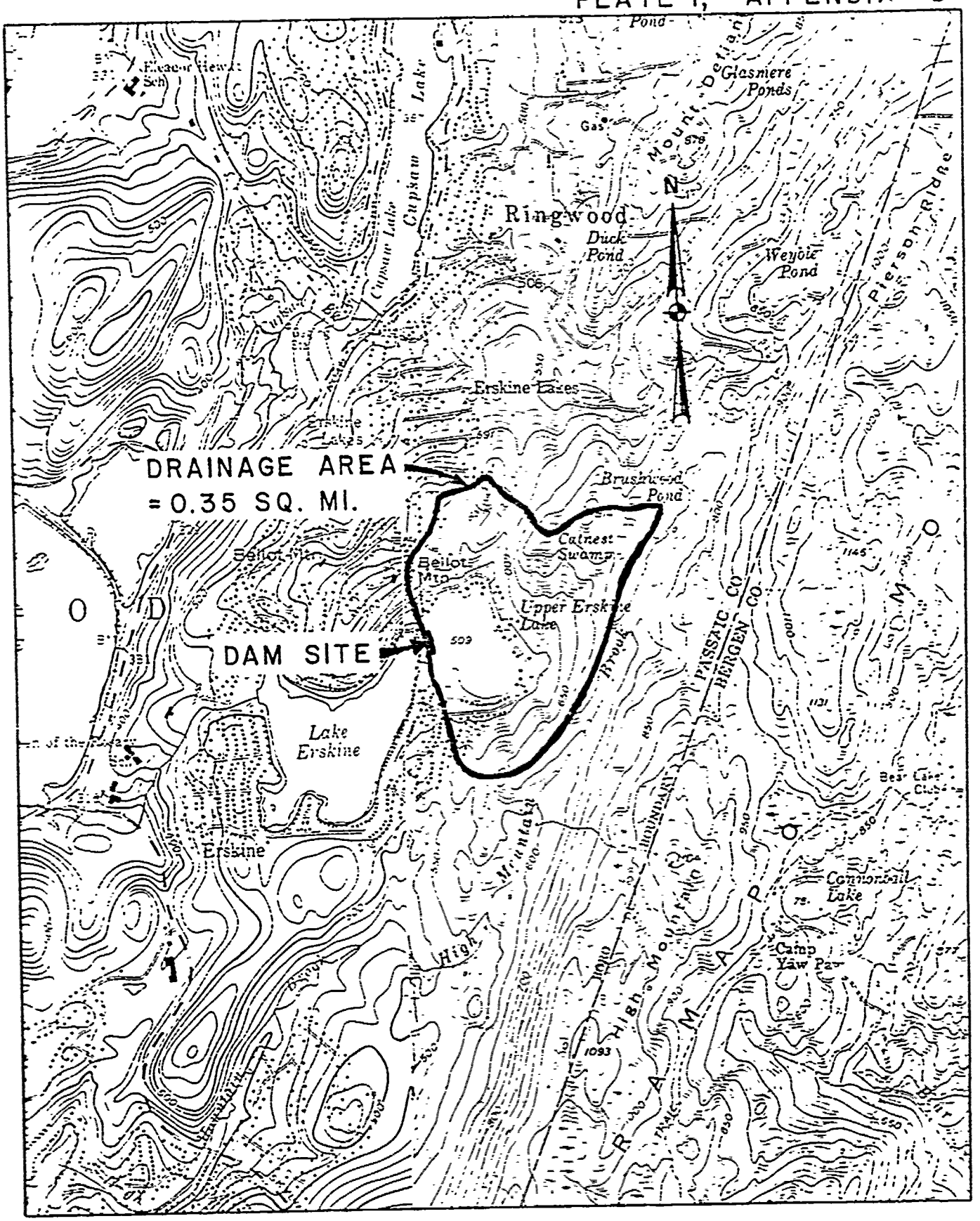
c. Records None

MAXIMUM NON-DAMAGING DISCHARGE: 351 cfs at el. 509 NGVD

APPENDIX D

HYDROLOGIC COMPUTATIONS

PLATE I, APPENDIX D



ERSKINE UPPER LAKE DAM
DRAINAGE BASIN

Size Classification

Surface area of Main impoundment	35 Acres
Average depth of Lake	10 ft ±
Structural Height of Dam	17 ft
Size Classification	Small

Hazard Potential Classification

Heavily travelled road and houses D/S of dam	
Hazard potential	High
Recommended SDF	½ PMF

Hydrologic Analysis

The HEC-1DB will be used to route the flood using SCS Triangular Unit Hydrograph with Curvilinear Transformation

DA = 0.35 Sq. Mi.

Precipitation

From Fig 15 the Drainage area located at between boundary Zone 1 & Zone 6 (Ref Design of Small Dam) Probable max. precip. = 25 inches for 6 hrs duration and 10 Sq Mi.

Duration (hrs	% of PMF Zone 1	Zone 2	Ave Value	
6	99	100	99.5	Value are reduced to account for Mis. in basin & storm orientation
12	111	109	110	
24	119	117	118	
48	127	126	126.5	

C

INFILTRATION DATA

Drainage area consists of Mat GMX24R & MMg

Hydrologic Soil Group	C
Initial Infiltration	0.8 INCH
Constant Infiltration	0.03 in/HR

Ref.: "Engineering Soil Survey of N.J., Report 3, Passaic County", by Rutgers University

TIME OF CONCENTRATION

1) Estimating Tc from velocity & water course length

	Slope (%)	Vel. (fps)	
Overland flow	$\frac{800-510}{3000} = 9.67$	2.0	Wooded land

$t_c = \left(\frac{3000}{2.0}\right)/3600 = 0.42$ HR.

2) From Nomograph "Design of Small Dam"

$\Delta H = 800 - 510 = 290'$ $L = 3600'$ $S = \frac{290}{3600} = 8.06\%$

$t_c = 0.18$ HR.

3) Using FAA Formula for Surface Flow (Airport Drainage)

$T_c = \frac{1.8(0.3)\sqrt{3600}}{\sqrt[3]{8.05}(60)} = 0.73$ HR.

C

Use $T_c = 0.44$ HR.

LAG $= 0.6\ T_c = 0.26$ HR.

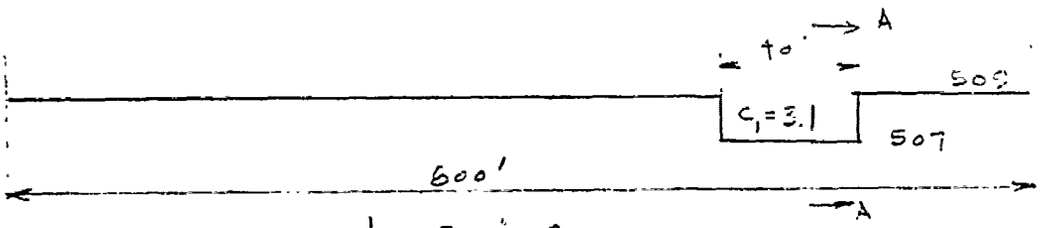
Elevation - Area - Capacity Relationship

Information obtained from USGS

Ele.	479.6*	507	510	520
Surface Area (Ac)	0	35.0	41.0	46.0

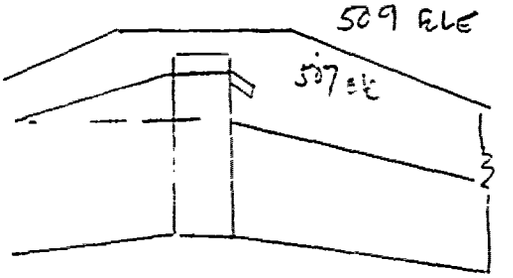
* Estimated bottom elevation of Lake at spillway

HEC-1DB program will develop Static capacity from surface area and elevations



$L_2 = 740'$ $C_2 = 2.75$

PLAN

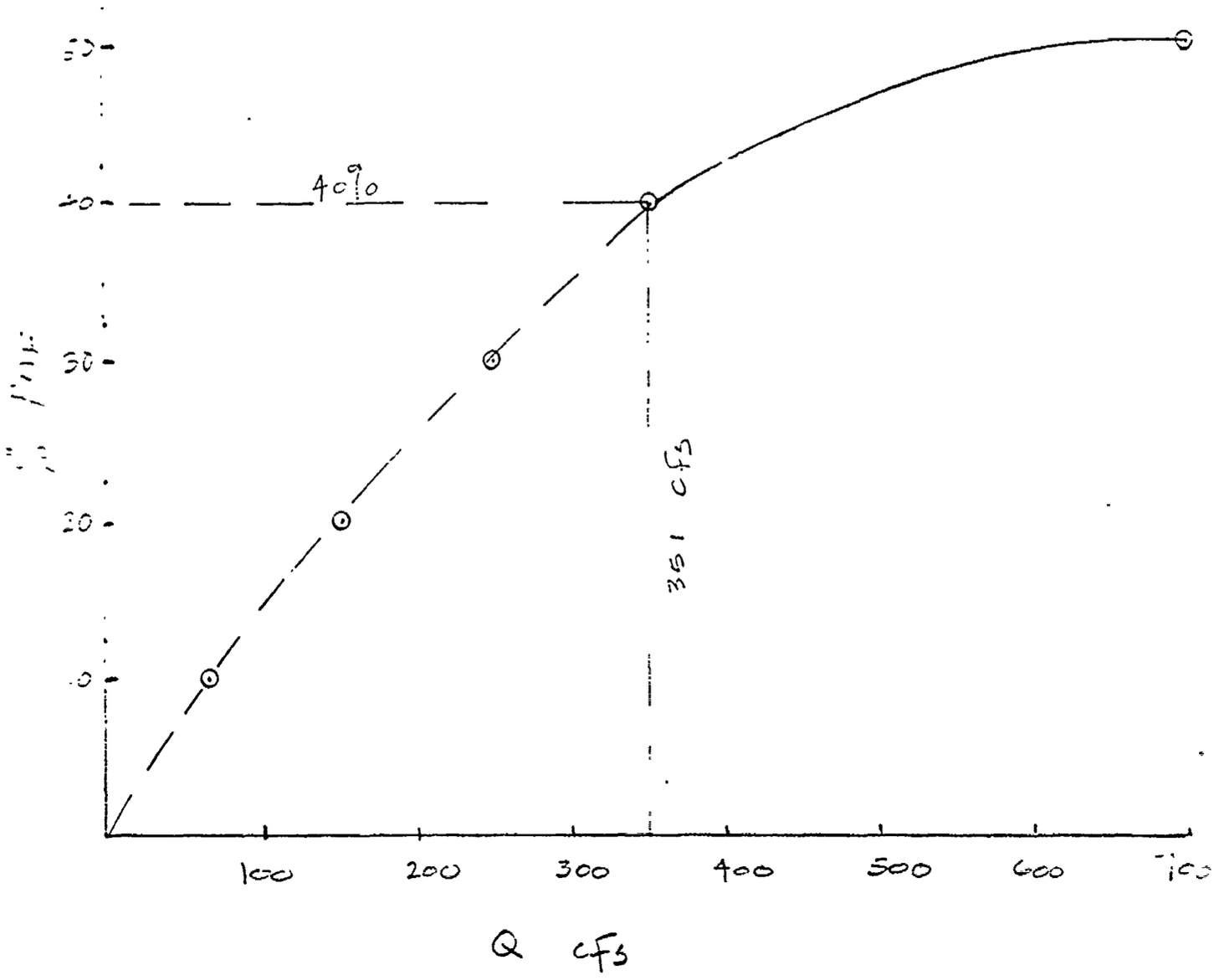


SECTION A-A

Use $C_1 = 3.1$ Broad crest Weirs (Icing & Grover Table 5-3)
$C_2 = 2.75$ HEC2 User Manual Feb. 1978

C

Overtopping Potential



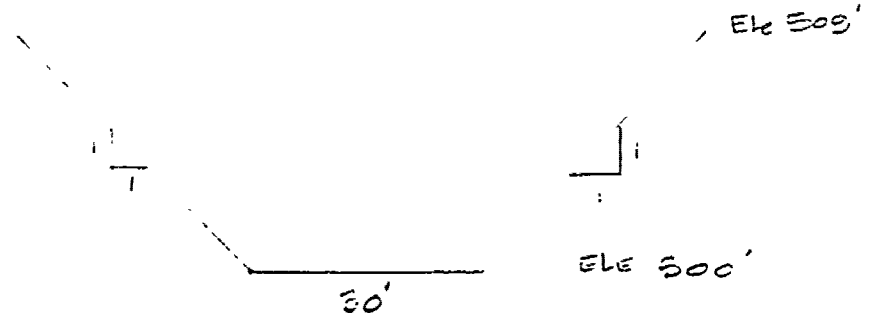
O

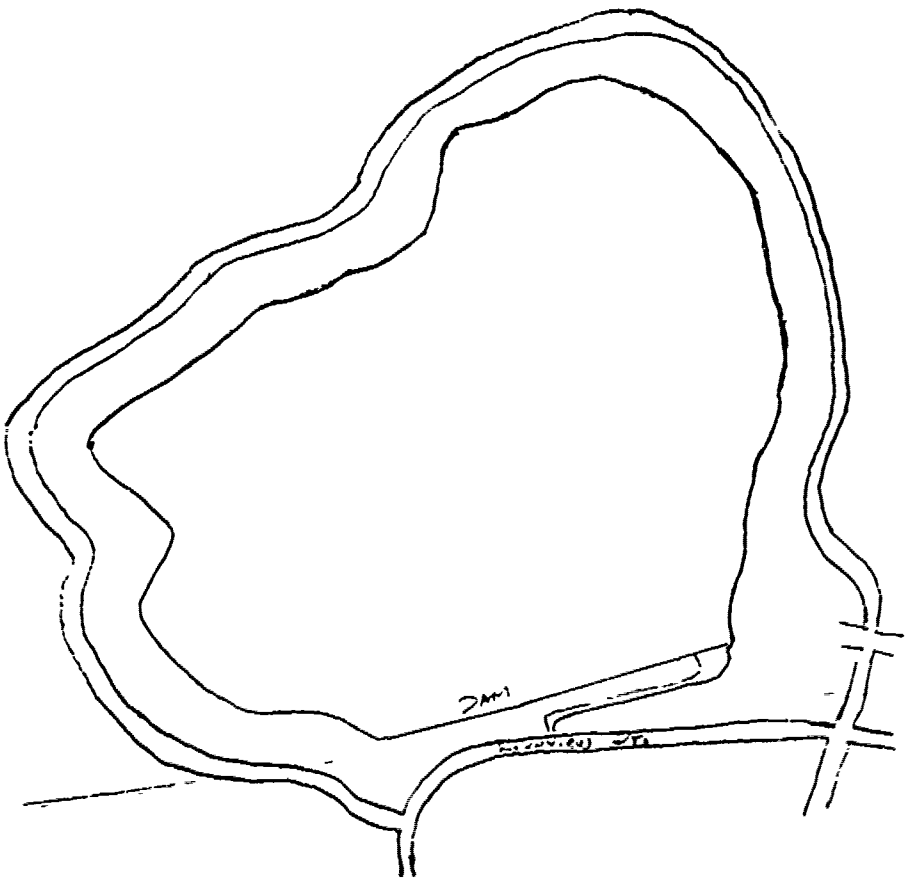
Overtopping of Dam occurs at Elev. 509 with Q = 351 cfs
(~ 40% PMF)

C. Breach Analysis

Assume Breach begins to develop when Lake Stage reaches Ele. 509.50 (0.2' Higher than the top of the Dam)

Time to = 0.5 hr



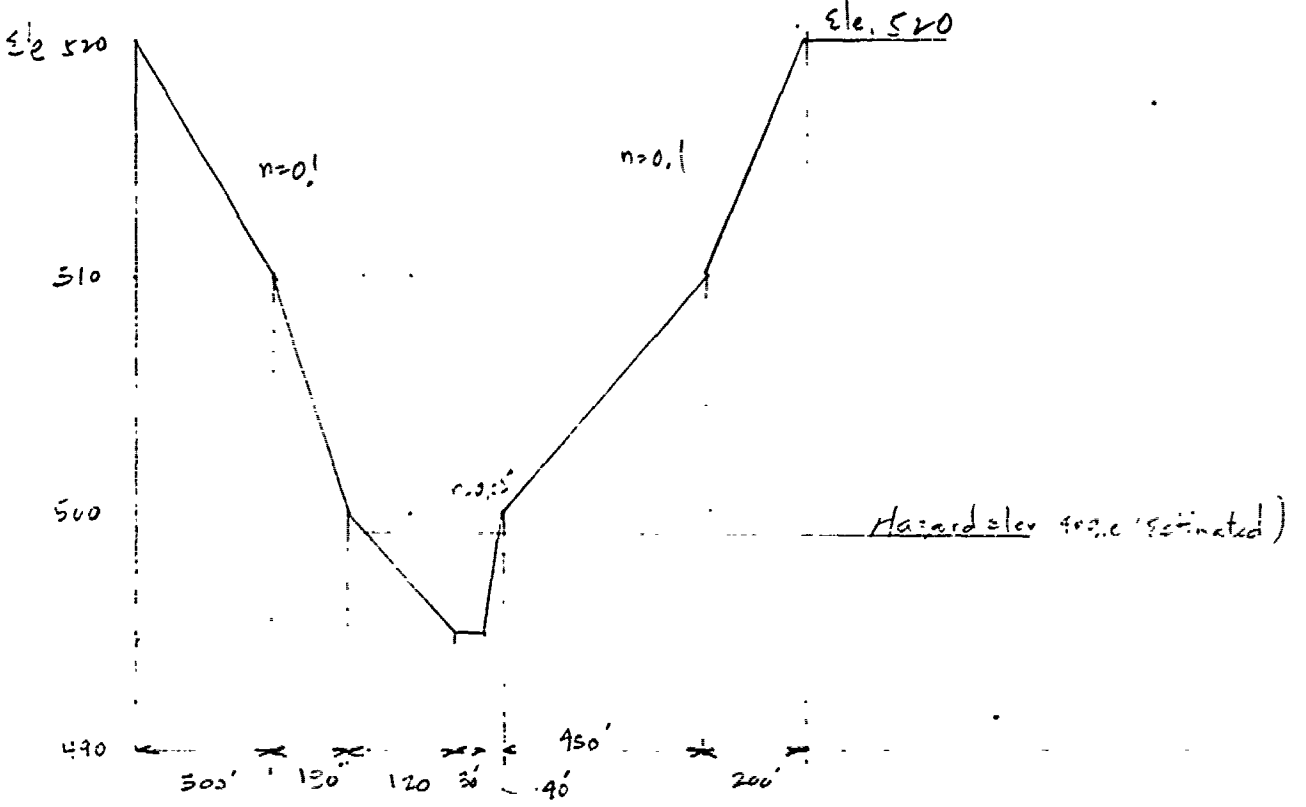


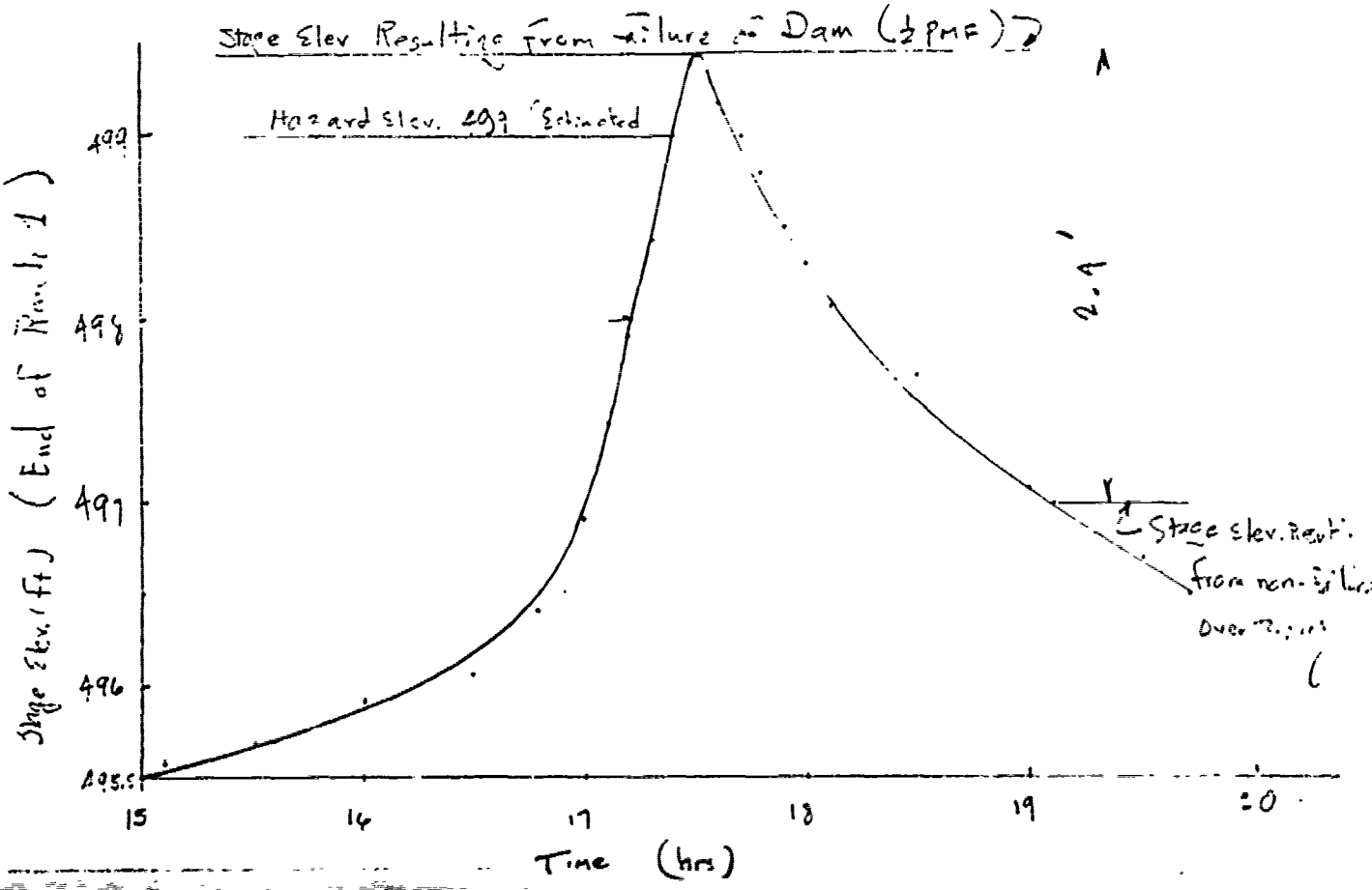
Station 1
(End of Reach 1)

PRC Harris, Inc.
CONSULTING ENGINEERS

SUBJECT N.J. Dam Emerg Prep. Group XVII
ERSKINE LAKE DAM
COMPUTED BY EK CHECKED BY C.L.C
SHEET No. 6 OF 7
JOB No. 10-[illegible]
DATE 12/83

Cross-section - End of Reach 1 (Station 1) S = 0.02

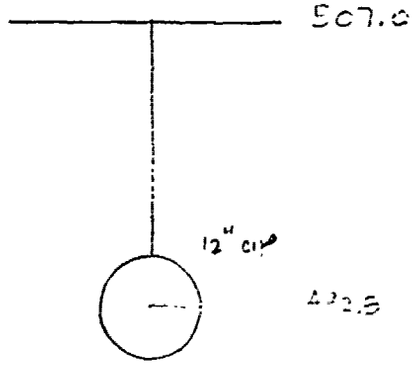




PRC Harris, Inc.
CONSULTING ENGINEERS

SUBJECT NJ Dam Insp. Prog. Group #11 — Erskine Upper Lake
COMPUTED BY EK CHECKED BY G.L.C.
SHEET NO. 7 OF 7
JOB NO. 13-A83-
DATE 3/5/80

Drawdown Time computation



Normal Elevation to Start @ 507.0

D.A = 0.35 Sq. M.

Inflows = 2 CFS Spec. = 0.7 CFS/sq. mi.

$Q = CA\sqrt{H}$ $C = 0.63$ $Q = 3.17\sqrt{H}$

For simplification Assume T.W. @ half depth of Outlet = 493'

Res Ele.	Area @ El	Ave Area	Vol Ac-ft	Ave Res. Ele	Q Ave Outlet discharge $Q = 3.17\sqrt{H}$	t_1 hrs Time of Drawdown $\frac{Vol \times 24}{43{,}560 \times Q}$	Σt Time hrs
507	35						
		33.75	33.8	506	14.6	28.1	28.1
506	32.5						
		30.13	60.26	505	13.6	52.9	81.0
504	27.76						
		25.58	51.15	503	12.4	49.2	130.2
502	23.39						
		21.4	42.79	501	11.2	46.3	176.5
500	19.40						
		17.59	35.18	499	9.1	44.0	220.5
498	15.78						
		14.16	28.32	497	7.9	43.5	264.0
496	12.54						
		10.46	31.37	494	4.0	95.1	359.1
492	8.37						

Time of complete drawdown with no inflow = 359.1 hrs ≅ 15 days

$A_1 \cong \frac{A_2}{(H_T+1)^2}$ $A_2 = 35$ Acre $h = H_T = 27.4'$

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A1       N J DAM SAFETY INSPECTION PROGRAM----GROUP XVII  10A8301
A2       N J 00197 ERSKINE UPPER LAKE, BERGEN COUNTY, NJ
AJ       MULT RATIO ROUTING,PRC-HARRIS INC., WOODBRIDGE, N J
R   240      0       6                                   0       0       4
B1    5
J     1      5       1
J1   .5     .4      .3      .2      .1
K     0                                  0       0       1
K1       LAKE INFLOW HYDROGRAPH THROUHG UPPER ERSKINE LAKE                  1
M     1      2      .35                 .35     0.8
P           25    99.5      110      118
                                                        0.8     0.08
T
U2       0 26
X    -1     - 05       2
N     1     DAM                                0       0       1
N1       ROUTING DISCHARGE THROUGH DAM
                                    1       1
Y                                                   -507       0
Y1    1
$A    0     35.0    41.0    46.0
$E  479.6    507     510     520
$$   507      40     3.1     1.5
$D   509    2.75     1.5     760
N     99
A
A
A
A
```

PASSAIC COUNTY, N.J.

N J DAM SAFETY INSPECTION PROGRAM----GROUP XVII 1008301
N J 00192 ERSKINE UPPER LAKE, ~~HEROEN~~ COUNTY, NJ
MULT RATIO ROUTING,PRC-HARRIS INC., WOODBRIDGE, N J

PASSAIC COUNTY, N.J.

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
240	0	6	0	0	0	0	0	4	0

JOPTR	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSIS TO BE PERFORMED
NPLAN= 1 NRTIO= 5 LRTIO= 1

RTIOS=	.50	.40	.30	20	.10

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SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH THROUHG UPPER ERSKINE LAKE

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
LAKE	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	.35	0.00	.35	.80	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	25.00	99.50	110.00	118.00	0.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	.80	.08	0.00	0.00

UNIT HYDROGRAPH DATA

TC=	0.00	LAG=	.26

RECESSION DATA

STRTQ=	-1.00	QRCSN=	.05	RTIOR=	2.00

UNIT HYDROGRAPH 15 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= .26 VOL= 1.00

119. 400. 545. 474. 299. 171. 104. 61. 36. 21.

13. 7. 5. 3. 1.

PME

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	END-OF-PERIOD FLOW COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.06	1	.01	0.00	.01	0.	1.01	12.06	121	.20	.19	.01	80.
1.01	.12	2	.01	0.00	.01	0.	1.01	12.12	122	.20	.19	.01	146.
1.01	.18	3	.01	0.00	.01	0.	1.01	12.18	123	.20	.19	.01	235.
1.01	.24	4	.01	0.00	.01	0.	1.01	12.24	124	.20	.19	.01	313.
1.01	.30	5	.01	0.00	.01	0.	1.01	12.30	125	.20	.19	.01	362.
1.01	.36	6	.01	0.00	.01	0.	1.01	12.36	126	.20	.19	.01	390.
1.01	.42	7	.01	0.00	.01	0.	1.01	12.42	127	.20	.19	.01	407.
1.01	.48	8	.01	0.00	.01	0.	1.01	12.48	128	.20	.19	.01	417.
1.01	.54	9	.01	0.00	.01	0.	1.01	12.54	129	.20	.19	.01	423.
1.01	1.00	10	.01	0.00	.01	0.	1.01	13.00	130	.20	.19	.01	427.
1.01	1.06	11	.01	0.00	.01	0.	1.01	13.06	131	.24	.23	.01	433.
1.01	1.12	12	.01	0.00	.01	0.	1.01	13.12	132	.24	.23	.01	450.
1.01	1.18	13	.01	0.00	.01	0.	1.01	13.18	133	.24	.23	.01	473.
1.01	1.24	14	.01	0.00	.01	0	1.01	13.24	134	.24	.23	.01	492.
1.01	1.30	15	.01	0.00	.01	0.	1.01	13.30	135	.24	.23	.01	504.
1.01	1.36	16	.01	0.00	.01	0.	1.01	13.36	136	.24	.23	.01	511.
1.01	1.42	17	.01	0.00	.01	0.	1.01	13.42	137	.24	.23	.01	515.
1.01	1.48	18	.01	0.00	.01	0.	1.01	13.48	138	.24	.23	.01	518.
1.01	1.54	19	.01	0.00	.01	0.	1.01	13.54	139	.24	.23	.01	519.
1.01	2.00	20	.01	0.00	.01	0.	1.01	14.00	140	.24	.23	.01	520.
1.01	2.06	21	.01	0.00	.01	0.	1.01	14.06	141	.30	.29	.01	527.
1.01	2.12	22	.01	0.00	.01	0	1.01	14.12	142	.30	.29	.01	552.
1.01	2.18	23	.01	0.00	.01	0.	1.01	14.18	143	.30	.29	.01	584.
1.01	2.24	24	.01	0.00	.01	0.	1.01	14.24	144	.30	.29	.01	613.
1.01	2.30	25	.01	0.00	.01	0.	1.01	14.30	145	.30	.29	.01	631.
1.01	2.36	26	.01	0.00	.01	0.	1.01	14.36	146	.30	.29	.01	641.
1.01	2.42	27	.01	0.00	.01	0.	1.01	14.42	147	.30	.29	.01	647.
1.01	2.48	28	.01	0.00	.01	0.	1.01	14.48	148	.30	.29	.01	651.
1.01	2.54	29	.01	0.00	.01	0.	1.01	14.54	149	.30	.29	.01	653.
1.01	3.00	30	.01	0.00	.01	0.	1.01	15.00	150	.30	.29	.01	654.
1.01	3.06	31	.01	0.00	.01	0.	1.01	15.06	151	.30	.29	.01	655.
1.01	3.12	32	.01	0 00	.01	0.	1.01	15.12	152	.38	.37	.01	666.
1.01	3.18	33	.01	0.00	.01	0.	1.01	15.18	153	.45	.45	.01	708.
1.01	3.24	34	.01	0.00	.01	0.	1.01	15.24	154	.60	.60	.01	800.
1.01	3.30	35	.01	0.00	.01	0.	1.01	15.30	155	1.36	1.35	.01	1028.
1.01	3.36	36	.01	0.00	.01	0.	1.01	15.36	156	2.42	2.41	.01	1598.
1.01	3.42	37	.01	0.00	.01	0.	1.01	15.42	157	.76	.75	.01	2344.
1.01	3.48	38	.01	0.00	.01	0	1.01	15.48	158	.60	.60	.01	2662.
1.01	3.54	39	.01	0.00	.01	0.	1.01	15.54	159	.38	.37	.01	2434.
1.01	4.00	40	.01	0.00	.01	0.	1.01	16.00	160	.30	.29	.01	1932.
1.01	4.06	41	.01	0.00	.01	0.	1.01	16.06	161	.28	.27	.01	1479.
1.01	4.12	42	.01	0.00	.01	0.	1.01	16.12	162	.28	.27	.01	1155.
1.01	4.18	43	.01	0.00	.01	0.	1.01	16.18	163	.28	.27	.01	936.
1.01	4.24	44	.01	0.00	.01	0	1.01	16.24	164	.28	.27	.01	803.
1.01	4.30	45	.01	0.00	.01	0.	1.01	16.30	165	.28	.27	.01	725.
1.01	4.36	46	.01	0.00	.01	0.	1.01	16.36	166	.28	.27	.01	678
1.01	4.42	47	.01	0.00	.01	0.	1.01	16.42	167	.28	.27	.01	651.
1.01	4.48	48	.01	0.00	01	0	1.01	16.48	168	.28	.27	.01	635.
1.01	4.54	49	01	0.00	.01	0.	1.01	16.54	169	.28	.27	.01	624.
1.01	5.00	50	.01	0.00	.01	0.	1.01	17.00	170	.28	.27	.01	617.

1	01	5	06	54	01	0	00	01	0	1	01	17	06	171	22	.21	01	606.
1	01	5	12	55	01	0	00	01	0.	1	01	17	12	172	22	21	01	581.
1	01	5	18	56	01	0	00	01	0	1	01	17	18	173	22	21	01	548
1	01	5	24	57	01	0	00	01	0	1	01	17	24	174	22	21	01	519
1	01	5	30	58	01	0	00	01	0	1	01	17	30	175	22	21	01	501
1	01	5	36	59	01	0	00	01	0	1	01	17	36	176	22	21	01	491
1	01	5	42	60	01	0	00	01	0	1	01	17	42	177	22	.21	.01	488
1	01	5	48	61	01	0	00	01	0	1	01	17	48	178	22	21	01	481
1	01	5	54	62	01	0	00	01	0	1	01	17	54	179	22	21	01	479.
1	01	6	00	63	01	0	00	01	0	1	01	18	00	180	22	.21	01	478
1	01	6	06	64	01	0	00	01	0	1	01	18	06	181	02	01	.01	456.
1	01	6	12	65	04	0	00	04	0	1	01	18	12	182	02	01	01	371.
1	01	6	18	66	04	0	00	04	0	1	01	18	18	183	02	01	01	260.
1	01	6	24	67	04	0	00	04	0	1	01	18	24	184	02	01	01	164
1	01	6	30	68	04		01	02	1	1	01	18	30	185	02	01	01	129
1	01	6	36	69	04		03	01	8	1	01	18	36	186	02	01	01	120
1	01	6	42	70	04		03	01	20	1	01	18	42	187	02	01	01	112
1	01	6	48	71	04		03	01	34	1	01	18	48	188	02	01	.01	105
1	01	6	54	72	04		03	01	45	1	01	18	54	189	02	01	01	98.
1	01	7	00	73	04		03	01	52	1	01	19	00	190	02	01	01	91
1	01	7	06	74	04		03	01	55	1	01	19	06	191	02	01	01	85
1	01	7	12	75	04		03	01	58	1	01	19	12	192	02	.01	01	79
1	01	7	18	76	04		03	01	59	1	01	19	18	193	02	01	.01	74
1	01	7	24	77	04		03	01	60	1	01	19	24	194	02	01	.01	69.
1	01	7	30	78	04		03	01	60	1	01	19	30	195	02	01	.01	64.
1	01	7	36	79	04		03	01	61	1	01	19	36	196	02	.01	01	60.
1	01	7	42	80	04		03	01	61	1	01	19	42	197	02	01	01	56
1	01	7	48	81	04		03	01	61	1	01	19	48	198	02	01	01	52.
1	01	7	54	82	04		03	01	61	1	01	19	54	199	02	.01	.01	49.
1	01	8	00	83	04		03	01	61	1	01	20	00	200	02	01	01	46.
1	01	8	06	84	04		03	01	61	1	01	20	06	201	02	01	01	42.
1	01	8	12	85	04		03	01	61	1	01	20	12	202	02	01	01	40.
1	01	8	18	86	04		03	01	61	1	01	20	18	203	02	01	01	37
1	01	8	24	87	04		03	01	61	1	01	20	24	204	02	01	01	34
1	01	8	30	88	04		03	01	61	1	01	20	30	205	02	01	.01	32.
1	01	8	36	89	04		03	01	61	1	01	20	36	206	02	.01	.01	30.
1	01	8	42	90	04		03	01	61	1	01	20	42	207	02	01	.01	28.
1	01	8	48							1	01	20	48	208	02	01	01	26.
1	01	8	54							1	01	20	54	209	02	01	.01	24.
1	01	9	00							1	01	21	00	210	02	.01	.01	23.

1 01	[illegible]	91	04	0.5	01	61	1 01	21 06	211	02	.01	.01	21.
1.01	9.12	92	.04	.05	01	61.	1.01	21.12	212	02	01	.01	20.
1 01	9.18	93	04	.03	01	61.	1.01	21 18	213	02	.01	.01	18.
1 01	9 24	94	04	0.5	.01	61	1 01	21 24	214	02	01	01	18
1 01	9 30	95	04	0.5	01	61	1 01	21 30	215	02	.01	01	18.
1 01	9 36	96	04	0.5	01	61	1 01	21 36	216	02	01	01	18.
1 01	9 42	97	04	0.5	01	61	1 01	21 42	217	02	01	01	18
1 01	9 48	98	04	0.5	01	61	1.01	21 48	218	02	01	.01	18
1 01	9 54	99	04	0.5	01	61	1 01	21 54	219	02	01	01	18.
1 01	10 00	100	04	0.5	01	61	1 01	22 00	220	02	01	.01	18.
1 01	10 06	101	04	0.5	.01	61	1 01	22 06	221	02	.01	01	18.
1 01	10 12	102	04	0.5	01	61	1 01	22 12	222	02	.01	01	18.
1 01	10 18	103	04	0.5	.01	61	1.01	22 18	223	.02	.01	01	18.
1 01	10 24	104	04	0.5	01	61	1 01	22 24	224	02	01	01	18.
1 01	10 30	105	04	0.5	01	61	1 01	22 30	225	02	01	01	18.
1.01	10 36	106	04	0.5	01	61	1.01	22 36	226	.02	.01	.01	18.
1.01	10.42	107	04	.05	01	61	1 01	22 42	227	02	01	.01	18.
1 01	10 48	108	04	.05	01	61	1.01	22 48	228	.02	01	.01	18
1 01	10 54	109	04	0.5	01	61	1 01	22 54	229	02	.01	.01	18.
1.01	11.00	110	.04	.05	01	61.	1 01	23 00	230	02	.01	.01	18
1 01	11.06	111	04	03	.01	61	1 01	23 06	231	.02	.01	.01	18.
1 01	11.12	112	04	0.5	01	61	1 01	23 12	232	.02	01	.01	18
1 01	11 18	113	04	0.5	01	61.	1 01	23 18	233	02	01	.01	18
1 01	11 24	114	04	0.5	01	61.	1.01	23.24	234	.02	.01	.01	18.
1 01	11 30	115	04	0.5	01	61.	1.01	23 30	235	02	.01	.01	18.
1 01	11 36	116	04	0.5	01	61	1.01	23 36	236	.02	01	.01	18.
1.01	11 42	117	04	0.5	.01	61.	1.01	23 42	237	02	01	.01	18.
1 01	11 48	118	04	0.5	01	61	1 01	23 48	238	02	01	01	18.
1 01	11 54	119	.04	.05	01	61	1 01	23 54	239	02	.01	.01	18.
1 01	12 00	120	.04	0.5	01	61	1 02	0 00	240	02	.01	.01	18.
								SUM	23.60	21 40	2.20		49102.
									(599.)	(543.)	(56.)		(1392.60)

	PEAK	6 HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2662	720	205.	205	49181
CMS	75	20	6	6	1393
INCHES		19.14	21.79	21 79	21.79
MM		486 05	553.35	553 35	553 35
AC-FT		357	406.	406	406
HOURS, CMS		440	501	501	501

HYDROGRAPH ROUTING

ROUTING DISCHARGE THROUGH DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DAM	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPNP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-507.	0

SURFACE AREA=	0.	35.	41.	46.
CAPACITY=	0.	320.	434.	860.
ELEVATION=	480.	507.	510.	520.

CREL	SPWID	COQW	EXPW	ELEVL.	COQL	CAREA	EXPL
507.0	40.0	3.1	1.5	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
509.0	2.8	1.5	760.

PEAK OUTFLOW IS 700. AT TIME 16.10 HOURS

PEAK OUTFLOW IS 355. AT TIME 16.30 HOURS

PEAK OUTFLOW IS 249. AT TIME 16.40 HOURS

PEAK OUTFLOW IS 151. AT TIME 16.50 HOURS

PEAK OUTFLOW IS 63. AT TIME 16.80 HOURS

1

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .50	RATIO 2 .40	RATIO 3 .30	RATIO 4 .20	RATIO 5 .10
HYDROGRAPH AT	LAKE	.35	1	1331.	1065.	799.	532.	266.
		(.91)	(	37.69)(	30.15)(	22.61)(	15.08)(	7.54)(
ROUTED TO	DAM	.35	1	700.	355.	249.	151.	63.
		(.91)	(	19.81)(	10.05)(	7.05)(	4.28)(	1.79)(

1 SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	507.00	507.00	509.00
STORAGE	320.	320.	394.
OUTFLOW	0.	0.	351.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	509.26	.26	404.	700.	1.40	16.10	0.00
.40	509.01	.01	394.	355.	.20	16.30	0.00
.30	508.59	0.00	370.	249.	0.00	16.40	0.00
.20	508.14	0.00	361.	151.	0.00	16.50	0.00
.10	507.64	0.00	342.	63.	0.00	16.80	0.00

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A1                N J DAM SAFETY INSPECTION PROGRAM---GROUP XVII  10A8301
A2                N J 00197 ERSKINE UPPER LAKE, ~~BERGEN COUNTY~~, NJ
A3                MULT RATIO ROUTING,PRC-HARRIS INC., WOODBRIDGE, N J
B    240          0       6                                  0       0       1
B1     5
J      2          1       1
J1    .5
N      0    LAKE                          0       0       1
N1                INFLOW HYDROGRAPH THROUHG UPPER ERSKINE LAKE
M      1          2     .35.              .3C     0.8                     1
P                25    99.5     110      118
T                                                  0.8     0.08
W2             0.26
X     -1        -.05     2
K      1         DAM                     0       0       1
M1                ROUTING DISCHARGE THROUGH DAM
Y                                 1       1
Y1     1                                           -507       0
$A     0        35.0    41.0    46.0
$C 479.6         507     510     520
$$   507          40     3.1     1.5
$D   509        2.75     1.5     760
$B    30           1     498     0.5     507  509.20
$H    30           1     498     0.5     507     600
K      1    REACH                                  1
M1          CHANNEL ROUTING
Y                                 1       1
Y1     1
Y6    .1          05      .1     495     520     100    0.02
Y7  1000         520    1300     510    1480     500    1600     49[illegible]    1630     495
Y7  1670         500    2120     510    2320     520
N     99
A
A
A
A
A
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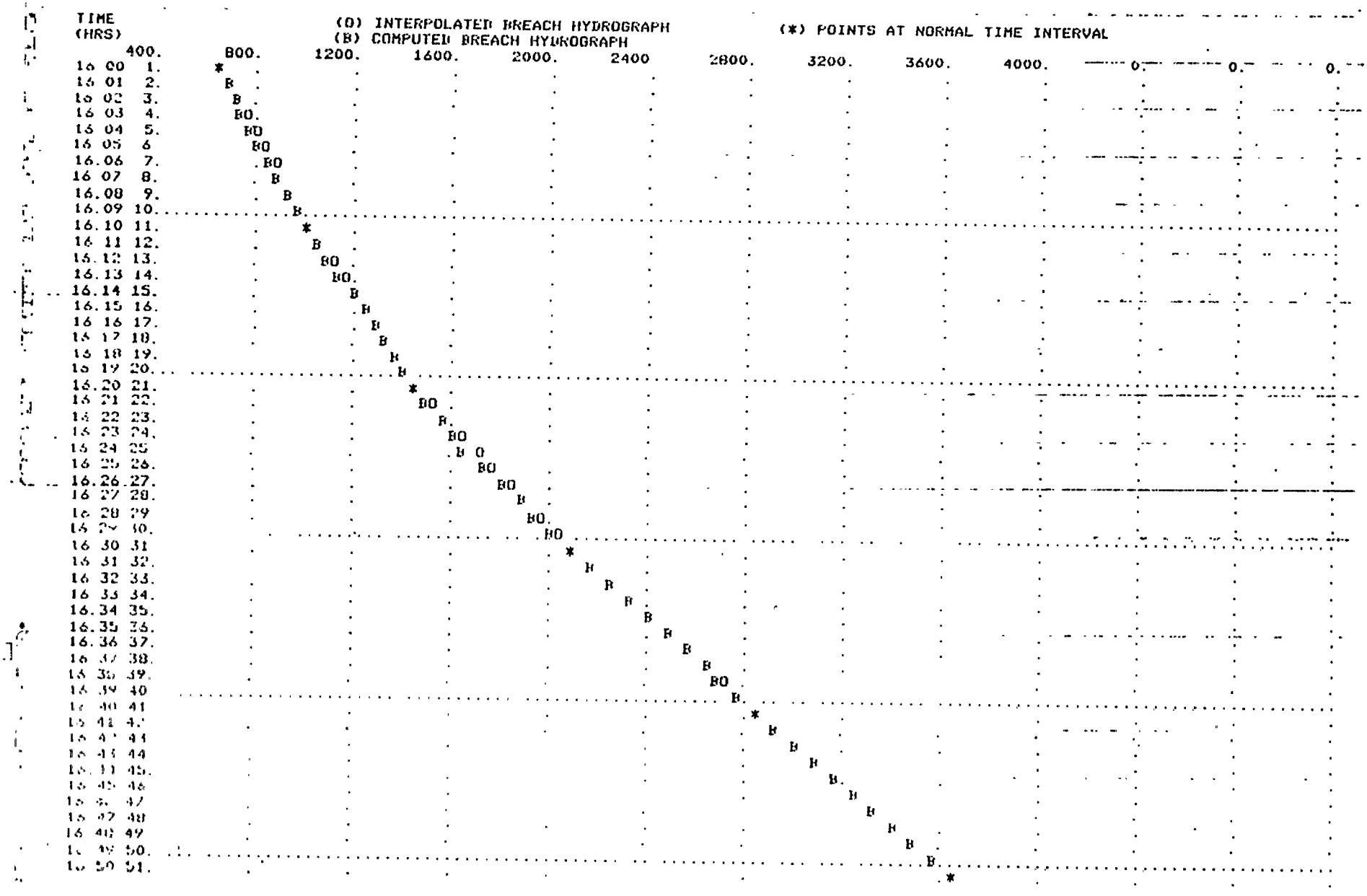
PASSAIC COUNTY, N.J.

STATION DAM


TIME (HRS)
(O) INTERPOLATED BREACH HYDROGRAPH
(B) COMPUTED BREACH HYDROGRAPH
(*) POINTS AT NORMAL TIME INTERVAL
400.
800.
1200.
1600.
2000.
2400
2800.
3200.
3600.
4000.
0.
0.
0.
16 00 1.
16 01 2.
16 02 3.
16 03 4.
16 04 5.
16 05 6
16.06 7.
16 07 8.
16.08 9.
16.09 10.
16.10 11.
16 11 12.
16.12 13.
16.13 14.
16.14 15.
16.15 16.
16 16 17.
16 17 18.
16 18 19.
16 19 20.
16.20 21.
16 21 22.
16 22 23.
16 23 24.
16 24 25
16 25 26.
16.26 27.
16 27 28.
16 28 29
16 30 31
16 31 32.
16 32 33.
16 33 34.
16.34 35.
16.35 36.
16.36 37.
16 38.
16 39.
16 40 41
16 49 50.
16 50 51.

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HYDROGRAPH ROUTING

CHANNEL ROUTING

	ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
	REACH	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

	NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
	1	0	0	0.000	0.000	0.000	0	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELMVT	ELMAX	RLNTH	SEL
1000	.0500	.1000	495.0	520.0	100.	.02000

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
1000.00 520.00 1360.00 510.00 1480.00 500.00 1600.00 495.00 1630.00 495.00
1670.00 500.00 2120.00 510.00 2320.00 520.00

STORAGE	0.00	.15	.44	.84	1.38	2.13	3.13	4.38	5.88	7.63
	9.63	11.89	14.38	17.07	19.97	23.06	26.35	29.84	33.53	37.42
OUTFLOW	0.00	269.77	1120.33	2737.38	5435.97	9852.98	15636.50	22928.95	31859.56	42551.11
	55121.77	69685.99	86572.01	105806.56	127289.58	151070.47	177205.81	205756.07	236783.89	270353.13
STAGE	495.00	496.32	497.63	498.95	500.26	501.58	502.89	504.21	505.53	506.84
	508.16	509.47	510.79	512.11	513.42	514.74	516.05	517.37	518.68	520.00
FLOW	0.00	269.77	1120.33	2737.38	5435.97	9852.98	15636.50	22928.95	31859.56	42551.11
	55121.77	69685.99	86572.01	105806.56	127289.58	151070.47	177205.81	205756.07	236783.89	270353.13

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	507.00	507.00	509.00
STORAGE	320.	320.	394.
OUTFLOW	0	0.	351.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	509.24	.24	403.	3639	.45	16.50	16.00

PLAN 2

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	507.00	507.00	509.00
STORAGE	320.	320.	394.
OUTFLOW	0.	0	351.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	509.26	.26	404.	700	1.40	16.10	0.00

PLAN 1 STATION REACH

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	3617.	499.4	16.50

PLAN 2 STATION REACH

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	700	497.0	16.10